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ABSTRACT

This collection contains articles from the journal "Planning for Higher Education" organized around four core spaces commonly found on a college or university campus. Following an introduction, Section 2, "Cultural Spaces," contains these articles: (1) "Planning the Successful Performing Arts Facility" (Wendell Brase, v18 n3); (2) "Frontier Acoustics for Music Buildings" (Russell Cooper, v21 n2); (3) "Art Buildings and ideology" (Graham Gund and Jonilla Dorsten, v23 n1); (4) "Planning for Museums on Campus" (Gail Dexter Lord and Margaret May, v24 n2); and (5) "Planning for Performing Arts Centers" [book review] (Richard Pilbrow, v25 n2). Section 3, "Instructional Spaces," contains: (6) "Classrooms for the 21st Century" (Michael Owu, v20 n3); (7) "Design Criteria for Effective Classrooms" (Wendell Brase, v17 n1); (8) "What Kind of Workstations for the Laboratories?" (Nolan Watson, v24 n1); (9) "What Size Libraries for 2010?" (Michael Matier and C. Clinton Sidle, v21 n4); (10) "Designing Better Classrooms" [book review] (Hunt McKinnon, v21 n2); (11) "Everything You've Wanted To Know about Laboratory Design" [book review] (Michael Reagan, Janet Ross, and Ray Porfilio, v23 n2); (12) "Designing Tomorrow's Laboratories" [book review] (Larry Anderson, v20 n1); and (13) "Controlling the Cost of Science Facilities" [book review] (Fred Tepfer, v22 n3). Section 4, "Student Spaces," contains: (14) "New-Wave Student Housing" (Earl Flansburgh, v19 n3); (15) "The Outburst of Student Recreation Centers" (David Body, v25 n1); (16) "The New College Bookstore" (John Finefrock, v21 n3); (17) "Residence Halls as a Place To Learn" [book review] (Carmen Guevara Neuberger, v23 n3); and (18) "Gender Equity in Athletics: What Does the Law Require?" [book review] (Marsha Moss, v24 n3). The final section, "Outdoor Spaces," contains: (19) "The Neglected Campus Landscape" (Michel Van Yahres and Syd Knight, v23 n4); (20) "Approaches to Contemporary Landscape Design" (Carol Johnson, v22 n2); (21) "Campus Architecture That Shapes Behavior" (James Burlage and Wendell Brase, v23 n3); and (22) "Landscapes, Work, and People" [book review] (George Anselevicius, v23 n2). Each article contains references. (Contains 3 tables and 29 figures.) (SLD)

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Special Planning for Special Spaces

Persis Rickes, Editor

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Selected Articles from *Planning for Higher Education*

Special Planning for Special Spaces

Persis Rickes, Editor

Society for College and University Planning
Ann Arbor, Michigan

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PREFACE

In some sense all campus spaces are special, but perhaps some are more special than others, requiring a unique planning twist. The intent of this edited anthology is to step back and focus on a few of these spaces in the hopes of providing new insights and strategic planning tools for occupants and planners alike.

This book is organized around four core space types typically found on a college or university campus in one form or another: cultural, instructional, student, and outdoor spaces. Many types of campus spaces exist, including those recognized formally by NCES in its *Postsecondary Education Facilities Inventory and Classification Manual* as well as some that might defy more conventional classification structures. It was thought that the four groupings included here best typify and reflect institutional character and identity. The manner in which these spaces are expressed, in both form and function, is an indelible statement of how the institution regards the role these spaces play in everyday campus life.

Planning for Higher Education (PHE), the premier journal of the Society for College and University Planning (SCUP), proved to be a rich fount of articles and inspiration for this volume. Some choices were difficult ones, and many more pieces would have been included if space permitted. Authors of those pieces selected for inclusion were invited to provide a postscript, if appropriate, and some elected to do so. In one instance, an author gave an older, well-regarded article an entire facelift.

In addition to the articles, select book reviews are interwoven throughout. *PHE* consistently identifies and reviews new literature in the field. The presence of a special selection of these reviews greatly expands the planning resources available to the reader.

Cultural Spaces are examined in four articles and one book review in the initial section. Although not all campuses may be fortunate enough to have freestanding, dedicated performance or display spaces, such spaces undoubtedly exist in some fashion and greatly enhance the institutional experience. In the first article, Wendell Brase provides a comprehensive and proactive series of suggestions for avoiding some of the pitfalls associated with planning a performing arts facility. Russell Cooper, in the second article, explores the means for addressing acoustical considerations in music buildings. Art buildings have moved to center stage, according to Graham Gund and Jonilla Dorsten in the third article, who go on to explore the associated planning implications. Gail Dexter Lord and Margaret May, in the fourth article, note that there are 600 museums governed by public and private education institutions in the United States; the authors suggest ways for a campus to integrate its museum into the academic and administrative structure.

The next section of this volume addresses *Instructional Spaces* through a combination of four articles and four book reviews. Although such space may comprise a relatively small portion of an institution's total space inventory, it frequently receives a significant amount of planning attention. In the first article, Michael Owu issues a clear call for assessing classroom space and provides some specific recommendations for doing so. Wendell Brase carries this thread into the second article, where he articulates numerous additional design criteria associated with successful classrooms. This article has been substantially updated especially for this volume. Workstation design in science laboratories is explored by Nolan Watson in the third article. Libraries can be considered a special type of instructional space and one article is included here. According to Michael Matier and C. Clinton Sidle in the fourth and final article in this section, library space needs are doubling every fifteen years and strategies must be found for coping with this spiraling need.

Student Spaces juxtaposes three articles and two book reviews on three very different types of student-related spaces. In the first article, Earl Flansburgh offers up the viewpoint

that student housing may be one of the most pressing campus planning matters of this decade. The student recreation center is an emerging building type, according to David Body in the second article, joining elements of a gymnasium and a student center. In the third article, John Finefrock tells us that bookstores sell more than just books and are being seen as a new kind of campus gathering space.

The final section in this volume, *Outdoor Spaces*, brings together four articles and one book review. In the first article, Michel Van Yahres and Syd Knight contemplate the impact of the spaces between the buildings, areas that are often neglected. This space is significant for a number of reasons, including the fact that high school seniors rely heavily upon the appearance of buildings and grounds when deciding whether to attend a particular campus. These thoughts and concerns are echoed by Carol Johnson in the second article, who goes on to describe additional ways in which the landscape can nurture the scholarly life. In the third article, Robert Brown addresses a more practical day-to-day issue, that of improving signage on campus. In the fourth and final article in this particular section, James Burlage and Wendell Brase provide a thought-provoking piece on how campus architecture influences social behavior both inside and outside the physical spaces we build for ourselves. They suggest ways we can creatively integrate these two types of spaces for mutual benefit.

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First, this volume would not exist without George Keller's professional and conscientious editorship of the Society's *Planning for Higher Education*, from whence these articles came. His commitment to editorial excellence has been a guiding beacon for the association, and the quality of his efforts are reflected herein.

Thanks also are due to staff members in the Society's central office who dedicated their time, expertise, and insight to see this project through to a successful conclusion. Among these individuals are Jolene L. Knapp, the Society's Executive Director; Susanne Kocsis, Assistant Director of Print Media, who shepherded this volume through publication; and Terry Calhoun, Assistant Director of Electronic Media, who originated the concept for the book and whose infectious good cheer kept it on track. Thanks also are due to Meredith Whiteley, Chair of the Society's Publications Advisory Committee, who has provided boundless energy and thoughtful leadership to this committee. It has been my distinct pleasure to work with each and every one of you.

In my office, I would like to thank Monica C. Meyerhoff for her quiet perseverance and assistance with some of the technical tasks associated with developing and assembling this volume.

Finally, this compilation would not have been possible without the fine work of the authors whose work is represented here. My deepest gratitude to you one and all.

A NOTE ON THE EDITOR

Dr. Persis C. Rickes has been an active member of SCUP for more than a decade. She is currently co-chair of the Membership Committee, active on the Publications Advisory Committee, and a member of the North Atlantic Regional Council. She is also a past Regional Representative and has served on a number of ad hoc committees as well.

Dr. Rickes is founder and principal of Rickes Associates, a Boston-based higher education consulting firm dedicated to campus and facilities planning. She has worked with a variety of colleges and universities throughout the northeastern United States.

II. Cultural Spaces

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This article summarizes planning and project management strategies that have proven effective in creating successful projects.

Planning the Successful Performing Arts Facility

Wendell Brase

Editor's Note: This article has been edited by the author especially for this volume.

Introduction

Universities and colleges are increasingly turning attention toward plans to upgrade their performing arts facilities. Relatively few fully successful performance or instructional spaces for music, theater, or dance have been built during the past fifteen years. New interest is now developing at a time when few recent successes can be relied upon as planning models.

This situation poses a problem of large proportions for the institution which is now planning either I&R (instruction and research) or performance facilities for a music, theater, or dance program. The stakes are high. The track record of performing arts facilities built by institutions of higher education includes many partial successes as well as some outright failures. And such failures are extremely expensive.

Wendell C. Brase is Vice Chancellor – Administrative and Business Services at the University of California, Irvine. With nineteen years of experience in the UC system (thirteen years at UC Santa Cruz, six years at UCI), Mr. Brase is responsible for UC Irvine's administrative, financial, and business services including a comprehensive program of process improvement and administrative streamlining (recently awarded first-place in NACUBO's Higher Education Awards Program). Earlier in his career, Brase was Associate Director of the Laboratory for Laser Energetics at the University of Rochester, a laser-fusion project, and Assistant Director of the Eastman School of Music. He has published several articles in *Planning for Higher Education*, has been a Director of the Society for College and University Planning, is active in NACUBO, and holds two degrees from the Massachusetts Institute of Technology.

Causes of Project Failure

This paper will identify major causes of failure of such projects and then summarize planning and project management strategies that have proven effective in creating successful projects, based on direct experience with about thirty performing arts capital projects in institutional settings. Most instances of failure of such projects fall into three categories:

- Cost overruns
- Functional nonperformance
- User disappointment

In discussing cost overruns, let us assume that the budget is adequate to achieve the institution's objectives for a project, not that the budget was inadequate in the first instance. "Functional nonperformance" means that the completed facility fails to satisfy the users' reasonable and stated functional objectives. "User disappointment" refers to a different matter: the situation when *unstated* objectives are not

met, or when there is confusion about functional objectives, or when there is disagreement about whether the "real" objectives have been understood and attained. This kind of project failure is as real as functional nonperformance gauged by objective measures, and it is characteristic of capital projects in the performing-arts domain, for reasons that this paper will attempt to illuminate.

These three categories of project failure–cost overruns, functional nonperformance, and user disappointment–find their roots in programming and design in the following rough proportions:[1]

	Programming	Design
Cost overruns	80%	20%
Functional nonperformance	60%	40%
User disappointment	95%	5%

So far I have painted a dismal picture. The good news is that the right kind of planning and project-management process can work effectively to prevent the kinds of problems and failures that are virtually ***guaranteed*** in the absence of good planning. Notice that "planning and project management" are regarded as part of the same process. That is lesson number one when it comes to a performing-arts project: many planning issues are so subtle that they become lost unless there is rigorous attention to detail in all stages of execution–design development, working drawings, specifications, plan-check, construction, and inspection.

Perhaps the most essential insight the planner in a college or university must bring to the task of planning a performing-arts I&R or performance facility is how different the process and the outcome must be from that of planning a similar facility outside of the institutional setting. This is not obvious to most administrators or planners. A good off-campus theater or concert hall would not necessarily be considered a good on-campus facility by faculty and students. The former is a public performance facility first and foremost; the latter is a laboratory facility in which the public performance aspect is of secondary importance. This is why joint planning processes which endeavor to provide for the needs of an off-campus community and of a faculty so often fail, not because faculty or community performing-arts organizations are so difficult to work with–as one often hears when the process breaks down–but because their objectives are different. Even when the joint planning process initially seems to work, the plan that emerges is often flawed: compromise ridden in an attempt to satisfy all participants and substantially over budget for the same reason.

The same pattern can unfold ***within*** an institution. Many participants in the planning process from within a college or university will think of a performing-arts project in terms of its public performance objectives. Others will conceptualize the project in terms of the I&R objectives. These differences can create a power struggle that is easy for administrators to overlook, since the participants often disagree on technical factors which obscure their larger differences regarding objectives, and they do so in a polite way, not wanting to sour the administration's regard for the long-awaited project. It is important to understand, however, that an entirely different set of premises encircles the public performance objective as contrasted with the curricular support objective, and the kind of institutional performing arts facility that emerges will differ based on whether the I&R or the public performance objective is given primacy.

As a planner, you must understand that an unresolved conflict between the primacy of I&R versus public performance objectives can destroy a project in the way that such differences in outlook can undermine a facility-planning process involving on-campus and off-campus performing arts participants. It is the chief executive's responsibility to clarify the primary and secondary objectives; such clarification is most effective at the outset, before the conflict emerges or positions become entrenched.

Ample evidence suggests that the best

performing-arts facilities (in a higher education institutional setting) usually result when the I&R functional objective is prime and the public performance benefit is considered a fortunate byproduct of an effective laboratory facility. This characterization may seem conservative, but it is entirely defensible and, with few exceptions, correct. Now let us turn to specifics.

Commonplace Programming Problems

Expectations Too Vague. The architectural program must specify what kinds of performance formats, repertoires, and audience sizes are expected. Leaving this to the imagination of the executive architect invites misunderstanding. (Moreover, leaving this to the *discovery* of the executive architect wastes the design budget.) Vague expectations usually lead to broad performance parameters, which in turn lead to expensive design solutions or compromises.

Lack of Architectural Program Detail. Without a detailed architectural program, no one involved in the design process can be held accountable for the results. This problem is exacerbated in a performing-arts project in which the multiple talents of acoustician, theater consultant, and other specialists can work either together or at cross purposes. The detailed architectural program provides the backbone around which design accountability is created. Conversely, in the absence of a statement of detailed program expectations and technical requirements, an otherwise adequate budget may be misdirected into a costly external design solution at the expense of functional value.

Unwillingness to Understand Compromises. No performance facility can serve equally well all repertoires, all performance forms, all presentation formats, and all audience sizes. The "all-purpose facility" is inevitably expensive and full of compromises. High-quality performance facilities result from a disciplined, focused appraisal of what really matters most. For example, a music performance facility can be designed to support both opera and nineteenth-century orchestral repertoire, but it will be more successful if its acoustics are optimized for one form or the other, rather than aimed at a mythical midway point that compromises both opera and orchestral performance. Such a trade-off should be firmly in the direction of the primary use (with consideration given to methods for acoustic adjustment that are simple and cost effective).

Misunderstanding the Economics of Audience Size. To design a performance space to accommodate the maximum expected audience makes no sense, unless money is unlimited. For example, if the extra 500 seats in a 2,000 versus 1,500 seat hall are actually sold out fifteen times a year, the incremental revenue per seat will be average ticket price times fifteen less several categories of expense. Analyzing this further, it is first useful to note that the 500 seats will be sold at the low end of the ticket price structure (typically discounted) — let's say $10 per seat in this example, so 15 X $10 equals $150 (gross revenue per incremental seat per year). The related expenses will include incremental staffing and, more important, the advertising expense that will be incurred *all season* in a continuing attempt to sell out the last 500 seats. The latter could easily amount to $75-100/incremental seat/year. Each seat entails about 20 square feet of space at the margin that must be heated, cooled, "janitorized," and maintained, requiring $180 per year including equipment depreciation. If we assume that the *capital* cost of this hypothetical performance facility is fully funded, our 500 extra seats are each generating about $150 in marginal revenue but incurring nearly $300 per year in marginal *expense.* The exact numbers in this example may vary among facilities and locales, but the basic relationship between incremental income and marginal expense is, regrettably, more commonplace than hypothetical.

Note that this analysis has nothing whatever to do with the cost of production or talent. The often-heard argument that a big house is necessary in order to support expensive talent is specious unless the marginal ticket revenues, based on the price structure and the frequency of selling the

entire house, exceed the associated marginal expenses for the added seats. The argument that a larger house will require "less subsidy" is also nonsense. The issue is whether the subsidy is required in the production budget or in the building-operations and advertising budgets.

Intuitively, as a rule-of-thumb, the sensible audience size ought to be that which can be filled to capacity for at least half of the events without requiring extraordinary advertising expenditures. A more precise answer is possible for each distinct facility based on a careful analysis which includes marginal costs as well as revenue projections based on realistic sales/attendance estimates.

This example is covered in detail because misunderstanding in this area leads many projects fundamentally off-track and far over budget. This is how problems typically occur: As pressure to increase audience capacity mounts, concerns about maintaining an intimate performance environment surface and escalate. "Intimacy" in a performance space is general gauged on the basis of the viewing distance from the stage to the most-distant seats. The design solution is predictable: balconies and a fan-shaped seating plans both of which reduce average distances to the stage. Introducing balconies and wider spans quickly escalates the budget, not only in terms of structural costs and the foundations required to support long-span structural elements, but also because balconies introduce special acoustical problems and the need for circulation, handicap access, restroom facilities, lobbies, and various patron amenities on every seating level. Moreover, the expense of providing comfortable air delivery is significant as the seating plan gets wider and as balconies are introduced.

The converse is clearly less expensive: a performance space that is more rectangular, allowing utilization of a regularized structural system spanning a limited enclosure width with no balconies, or at most a shallow balcony.

The problems of providing good acoustics in a performance space that is large and wide extend beyond the issue of construction cost. Attaining good speech conditions becomes markedly difficult as the theater grows beyond about 800 seats, just as attaining good music acoustics gets sharply more problematic as an opera facility exceeds 1,500 seats or a concert hall exceeds about 2,000 seats. For the sake of your budget and for good acoustics, smaller numbers than these are advisable. (In the case of a facility used for an opera and music theater a space larger that 1,500 seats is also undesirable for the training of young voices.)

Underestimating the Impact of Site on the Budget. As planners, we are usually sensitive to the impact of slope and soil conditions and utility costs on a capital budget. In the case of a performance facility, another site condition has equal impact: the quietness of the site. Other site conditions and factors being equal, sitting a performance facility at least 150 feet from major vehicular circulation[2] can favorably impact a budget as much as 10 percent. Many performance facilities are structurally massive because they attempt to attain large capacity and performance intimacy, as already discussed, and they are built on noisy sites. Of course, many campuses cannot provide a site which meets the setback criterion of 150 feet. In such cases, the building configuration can affect significantly the expense of creating interior spaces that are sufficiently isolated from vehicular noise.

Making the Smaller Facility Less Versatile. Many performing-arts facilities contain two or more performance spaces of different sizes. The programming tendency is to build as much technical ad production flexibility as possible into the larger/largest facility. This decision is not necessarily a mistake, but it does not make the trade-off in the direction of maximum expense. "Flexibility" refers to the technical ability of the stage and the lighting system to support a wide range of repertoire and performance forms. Such a stage is typically fully convertible; for example, in a music facility the stage would have a fly gallery, an orchestra pit, extensive wings, a forestage elevator, massive access doors and corridors, traps, an extensive theatrical lighting system, pos-

sibly an adjustable proscenium, and certainly a demountable "orchestra shell" to enable conversion of the stage to a fully enclosed acoustical enclosure for orchestral, choral, and chamber music performances.

The hall associated with such a stage would have extensive acoustical adjustability, multiple balconies, a wide span for purposes of performance intimacy (as had been discussed), and multiple-lighting positions. Suppose an institution builds two music performance spaces, of 500 seats and 1,500 seats, and that one facility incorporates all of the features just outlined, while the other facility is at the other end of the versatility scale—a noncovertible stage, a nontheatrical lighting system, a simpler structural system with shorter spans, less acoustical adjustability—in other words, a good, basic, "concert hall" suitable for orchestral, choral, recital, and chamber music performances. Making the smaller hall the versatile hall and the larger hall the more basic performing space will save—all other factors being equal and keeping the total number of seats constant at 2,000—in excess of 25 percent. Of course, if the larger hall were 1,650 seats and the smaller facility were 350 seats, the cost differential would be even greater (closer to 35 percent). Incidentally, a good example of making that larger music performance facility less complex and the smaller one more complex can be seen at the University of Illinois' Krannert Center, where the concert has been executed successfully in a way that has stood the test of time.

The Expense of "Statement" Lobbies. Normally, given the choice between, say, a better stage (more technical, more functional) and a grand lobby, faculty and administrators would favor the former. The problem is that when the architectural program does not clarify this expectation, its significance on the budget is not understood until an executive architect has structured an entire design concept around a lobby which is too grand. Of course, the lobby is undeniably part of the audience experience, but here again the curricular function of the theater or concert hall as a laboratory must be given priority in the institutional setting. It is a mistake to assume that this point is too obvious to address in the architectural program. In a gift-funded project, however, a lobby may have strong donor appeal, although sophisticated donors will readily understand the possible trade-offs.

Value-Engineering Process Begins Too Late. Value engineering is essential for a performing arts facility for several reasons:

- Such facilities embody design and program complexity.
- Peer review generates alternatives and provides ballast when forceful participants in the planning process overwhelm other participants with their specialized technical knowledge or assertions of artistic prerogative.
- In performance facilities, value engineering can flush out in a structured way more alternatives that are immediately apparent.
- Value engineering forces the involvement of required consultant-specialists in the trade-off decisions that matter most in the early stages.

The message so far in this discussion has been that fundamental trade-off decisions and program assumptions have massive and irreversible impacts on the budget and on the success of a project. Therefore, in order to be effective, the first value-engineering session should be scheduled upon completion of the architectural program but before schematic concepts are developed.

Common Design Problems

Internal Zoning. All performance facilities—whether for theater arts, dance, or music—require a critical level of sound control. In many cases, this can be alternatively accomplished through internal zoning or through the way a building is technically designed and constructed. "Zoning" simply means separating problematic, noisy, and vibration-generating functions and machinery from spaces that have a critical need for quiet. It means inserting storage spaces and quiet circulation elements strategically, as buffer zones; locating mechanical rooms carefully; isolating receiving docks; keeping air-handling equipment off roofs; avoiding walking surfaces over any space that must be quiet; and routing exterior circulation away from

penetrations in the building envelope, such as openable windows and air intakes. Sometimes acoustical consultants inadvertently perform a disservice by inspiring too much faith in technical solutions to noise problems that could be more surely and less expensively remedied in the first instance through more thoughtful interior zoning.

HVAC Problems. Three HVAC problems are commonplace, all deriving from the stringent, ambient noise-design criteria required for a successful performance space. The first problem is the mechanical engineer who is inexperienced with such systems. The second problem arises when the mechanical engineer does not get involved early enough in the building's volume allocation to reserve adequate space for risers, plenums, and mechanical rooms. The third problem is that an unrealistic budget for the HVAC system takes root early in the project, often derived from an inadequate statement of pertinent program requirements.

Poor Analysis of Sightlines. The problem of poor analysis of sightlines is so basic that it should never occur. Never accept the architect's assertion that "we have checked the sightlines" or, worse yet, that "the seating vendor checked the sightlines with a computer program." Make the designer show you both vertical and horizontal sightline clearances on paper from the most problematic seats, such as rear corners, front corners, rear balcony corners, all side balcony positions, and any seating position where the floor slope makes a transition. In reviewing plans, be skeptical about a floor slope that does not vary markedly from front to rear seating and from main floor to balcony, and put no faith into offset-seat placement (since the viewing angle subtended from an offset seat will reveal only a fraction of the stage). Extra attention to this problem-prone area of design on the part of the client will help to ensure designer accountability.

Inspection Problems. Performance spaces contain many details of such technical subtlety that the chief inspector must be involved from an early stage in value-engineering and design-development discussions and in plan review. In addition, critical items should be highlighted by the acoustician at the preconstruction conference. Only when acoustical functions and technical objectives of certain design features and construction details are understood in depth can inspection be fully effective.

Client Noninvolovement in Trade-offs. The design process must be managed in a way that brings trade-off decisions into focus for users. In particular, trade-offs involving aesthetics versus functionality should be made by the client. There are two ways to structure the design process so that trade-off decisions do not get buried: (1) retain acoustical and theater consultants directly rather that as subcontractors to the executive architect; (2) use the value-engineering process to illuminate trade-offs, to explore alternatives, and to provide a context of professional peer review and expertise for clients to tap when making trade-off decisions. These recommended practices are not intended to suggest that aesthetic attributes of the design should be systematically specified for the sake of functionality, or that all trade-offs can be categorized so neatly. The point is that every stakeholder—client, architect, donor, trustee, and end-user—benefits when trade-offs are pinpointed, explained, and evaluated in a process which involves informed clients.

Conclusion

The programming and design problems that have been discussed do not comprise an exhausted list of potential pitfalls. Instead, the focus has been on *fundamental* issues that often prove pivotal in determining whether a project emerges as a functional success within its budget. Many of the planing and design problems that have been discussed are practically irreversible and impossible to remedy beyond a certain stage. Yet in the institutional environment, with its tendency to use committees in ways that often seek consensus through compromise, unsatisfactory and expensive outcomes emerge from lack of understanding of the full cost impact of certain program factors, from the desire to meet everyone's needs in a democratic fashion, from the lack of clarity about the

primacy of public performance versus circular support objectives, and from the significant decisions that get locked in while the planning process consumes time trying to reach consensus. A sophisticated awareness of these problems on the part of the planner can enable him or her to structure the planing and project management process in ways that will result in a satisfying, effective and affordable project. ■

FOOTNOTES

1. Based on author's involvement in planning, programming, or overseeing construction of about thirty performing-arts facilities. Since this paper was presented at SCUP-24, many readers have provided anecdotal concurrence with these rough proportions.
2. "Major" vehicular circulation refers to roads that carry traffic at highway speeds and/or frequent truck, bus, or emergency-vehicle traffic.

An expert describes the vital role of acoustical planning for the sound of music.

Frontier Acoustics for Music Buildings

Russell Cooper

Music buildings are different. They require sophisticated advance planning to control and direct sound and noise. They are more expensive. The architecture and construction engineering need to be shaped to accommodate acoustical needs. And the interior design requires special handling to enhance or to muffle sound. Any college or university that is building a new music hall or renovating an existing one must recognize that there are exceptionally difficult design problems that necessitate early and expert acoustical planning.

Music buildings must provide appropriate music environments for teaching, practice, performance, rehearsal, and recording, and they must satisfy the tastes of numerous professors, some of whom are outstanding instrumentalists or composers themselves. These music environments raise design issues such as the acoustics of individual rooms, sound and vibration isolation from external and internal noises, and mechanical system noise control. Acoustical requirements raise the cost of these buildings way beyond the cost of classroom buildings.

Most campus music schools are also used for performances for and by community groups, and for touring dance, music, and theater groups, as well as individual artists. Of course, each locality has different requirements. For example, a music school in a major city like New York or San Francisco which has several concert and recital spaces does not need to build a hall for professional concerts. However, when Cleveland State University planned its new building it had to include a 1000-seat recital hall because Cleveland did not have a satisfactory mid-size concert hall. (See Figure 1.) Likewise, when the University of Indianapolis planned a fine arts extension, the president asked for a 500-seat recital hall so that the college could attract touring performers and groups to raise revenue.

At Interlochen Music Academy in Traverse City, Michigan, the curriculum included musical theater, dance, and drama as well as music; and the city lacked a main performance venue. So the stage at Corson Hall was designed in a proscenium format,

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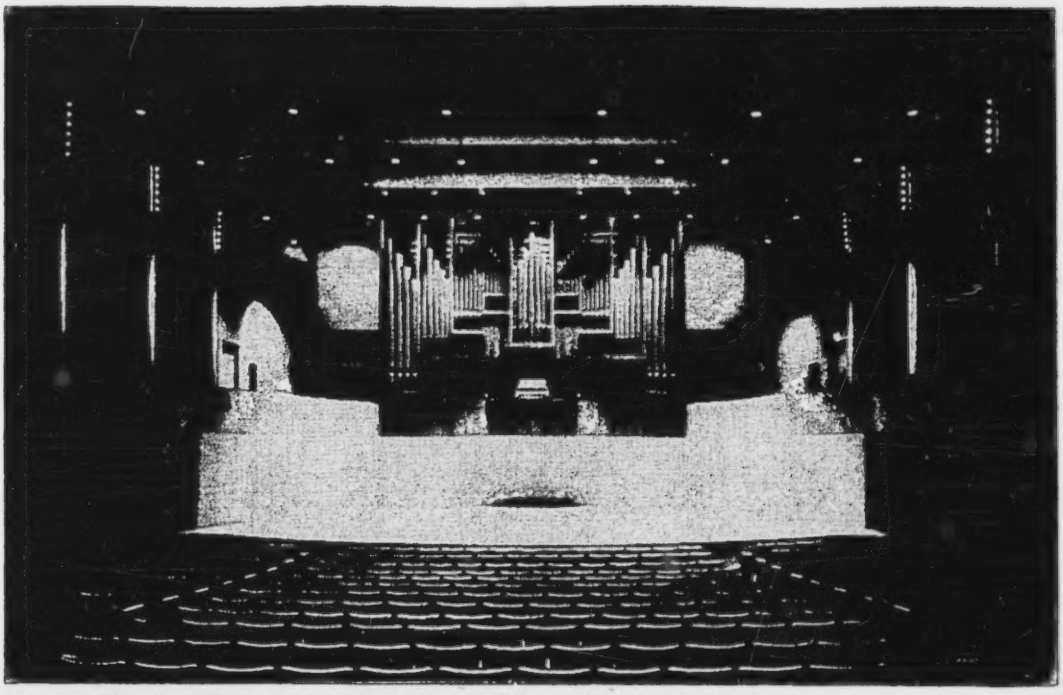


Figure 1. Cleveland State University had to build a mid-size recital hall.

incorporating a limited capacity for flying scenery, so that dance and drama could be presented as well as acoustically sharp music performances. (See Figure 2.)

Thus, the first planning consideration for college leaders is how the music building will be used, and by whom. Then you will be ready for specific acoustical planning.

Those handsome recital halls

The crown jewel of every music education facility is its recital hall. This is what campus visitors come to admire and musicians want to be perfect.

Recital halls are very difficult to design, and college recital halls are especially tough. University and conservatory halls need to accommodate everyone from a single piano, violin, or harp soloist to a full symphony orchestra with a chorus of 200 or 250 voices. So the design of a conservatory recital hall should have a larger volume-to-seat ratio then would the 2,500 seat symphony hall downtown. Whereas the symphony hall might have 350 cubic feet per seat, the college hall should have 450 to 600 cubic feet per seat. This translates into spaces that can be 45 feet high.

Also, university music hall platforms should be large enough to handle an orchestra and a large choir, so approximately 2000-2500 square feet is the minimum required. Yet, when smaller groups perform on stage, they must not feel alone and tiny on a sea of stage. So portable sound-reflective and diffusive shell panels should be used to surround the smaller groups. The difference in sound power between large symphony orchestras and small chamber groups requires architectural elements such as variable draperies and panels, portable absorptive units, tunable reflectors, and demountable shell panels to enable the hall to function properly. Because of all these acoustical requirements, it is common for the cost of a college recital hall to be a high $150-$175 per square foot.

The most sought-after acoustics for a recital hall is a noise-free environment where listeners feel enveloped in a sonic environment that is considered "warm."

Figure 2. Corson Hall at Interlochen Music Academy in Michigan had to include a proscenium stage to allow dance and dramas as well as music.

Noise-free simply means being very, very quiet. Being enveloped means having the sound be heard by the listener from all around, particularly from the sides. Warmth is associated with an abundance of low-frequency sound. How does a college achieve these qualities?

The crown jewel is the recital hall.

Even the lowest energy instruments, such as a solo violin, deserve a chance to be heard distinctly. Hence it's imperative that the hall be exceedingly quiet, as noise-free as possible. Air conditioning or heating fans should not be heard. Nor should environmental noise from overhead airplanes, nearby subways and trains, or automobile roars, screeches, and horns.

This means that air conditioning equipment for recital halls should be located in a basement far away from the hall or in a separate building, never on the roof. The air ducts should be larger than usual for low-speed, quiet air delivery. Air is usually "dumped" or allowed to trickle down from holes in the ceiling, and is returned via numerous openings near the hall's floor. In urban sites where environmental noise is a problem, it is necessary to have four to six-inch-thick concrete roofs, 12 to 24-inch-thick exterior concrete walls, acoustical doors and windows, and "floating" structural systems.

As I said earlier, the proper volume for the hall will insure that the sound energy is contained and reinforced to provide loudness. But architectural details can influence the quality of sound. These details include wall and ceiling geometry, the selection of proper materials for surfaces, and specialty acoustical elements. This leads us to the second requisite: envelopment.

Envelopment, or being immersed in the sound, can be achieved by reflecting or diffusing the sound from the musicians off the side walls and ceiling to arrive at the listeners from all angles. Actually this reflected sound should reach the listeners

slightly later than the direct sound from the stage. This time delay creates a perception not unlike that of hearing in stereo. When we listen to music outdoors it can sound flat and one-dimensional because there are no reflections. So it is important that the side walls and ceiling be carefully angled and shaped to reflect and diffuse sounds. In some instances suspended ceiling reflectors need to be installed.

The third sought-after quality is warmth. Warmth is associated with low-frequency sound, so music hall architects must make sure that materials selected for the hall do not absorb low-frequency energy. This requires that most boundary surfaces be solid and rigid since vibrating panels absorb low-frequency energy. This means concrete, plaster, and gypsum board surfaces. Contrary to common belief, wood often hampers good acoustics, although wood applied directly to a massive back-up material such as concrete so it won't vibrate can avoid low-frequency absorption.

The greatest absorber of sound is the audience and its clothing.

The greatest absorber of sound in a recital hall is the audience and their woolen, cotton, or synthetic clothing. But sometimes there are empty seats, so the seats must simulate acoustically the effect of being occupied. This can be accomplished by installing chairs with upholstered seats and backs with a tightly wrapped fabric over a $1\frac{1}{2}$-inch cushion. Since the seats cover much of the floor area, recital halls do not need carpeting except in the aisles.

Just as the audience needs good acoustics, so too do the musicians. Therefore, the performance platform must incorporate wall and ceiling shapes that reflect and diffuse sound not only out to the audience but to the other musicians on stage. In this way the orchestra members can hear themselves and adjust the balance and tone of their sound. Lower, suspended reflectors over the performance platform are often necessary to help reflect sound within the orchestra. These panels should be integrated into the architecture of the hall, and should be more "open" spaced than "closed" to allow for low-frequency sound energy to communicate with the volume above the reflectors to preserve the "warmth."

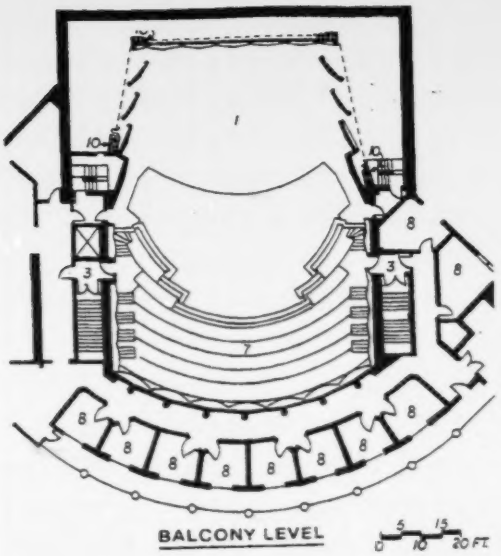
Architecture details can influence the quality of sound.

A reminder. A recital hall is essentially a single-purpose music space. College leaders should not try to make it function as a theater also. I have seen terrible acoustical disappointments where a music hall is expected to satisfy several different uses.

Rehearsal, teaching, and practice rooms

These rooms are more dedicated spaces. They vary in size and cubic volume, depending on the sound power levels of the instrumentalists or ensembles using the space. Rehearsal rooms for an orchestra or chorus should not be less than 25 feet in height. Choral rooms require 20 square feet per person, instrumental rooms 30 square feet per person. Rooms smaller than this tend to be loud and oppressive. Some try to put absorptive panels in the room to reduce the loudness, but this results in a "boomy" or "muddy" sounding room.

These practice and rehearsal rooms should not be as reverberant as the recital hall, but neither should they be "dead." The goal is to provide a pleasing musical environment in which the professor and ensemble can hear themselves and identify articulation and pitch problems. I recommend movable acoustical elements for these rooms so that the acoustical environment can be tailored to the different user group preferences. Among the simplest devices are velour draperies that track



Bennett Hall

1. Performance Platform
3. Sound Lock
7. Balcony Seating
8. Practice Rooms
9. Control Room
10. Acoustic Drapes

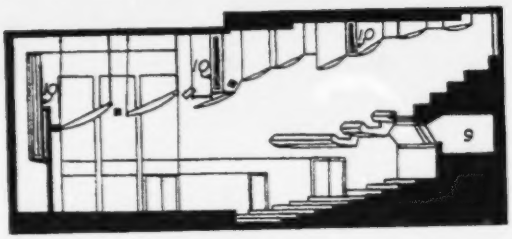


Figure 3. Bennett Hall in Highland Park, Illinois, has moveable acoustical elements for different user groups.

along the walls and can be hidden in pockets when not in use. (See Figures 3.)

Sound and vibrations

One of the most important tasks in a campus music building is the isolation of sound from space to space, especially since the rooms are usually in close proximity. Spaces used for high-sound power instruments such as percussion, organ, brass, and large chorus should be larger and of double height, and should be located on grade. Wherever possible, corridors and storage rooms should be used as acoustic buffers between these noise-sensitive rooms. These two steps can reduce costs by eliminating costly floating floors and double masonry wall constructions.

Studio and practice rooms are usually located next to each other, so sound isolation between adjacent rooms is imperative. This can be done by the following construction:

- Combination masonry and gypsum board walls
- Floating wood floors over concrete slabs
- Resiliently mounted gypsum board ceilings. (Figure 4.)

For practice rooms, universities should consider modular, pre-fabricated construction, which offers a low-cost, guaranteed acoustical alternative to general construction.

Doors to music practice rooms should always be acoustical steel doors with a rating of Sound Transmission Class (STC)-47. (Regular doors have a STC rating of 20 or so.) A door of this type costs about $1,500 but is worth it because the cost of all the other isolated construction will be wasted if the doors are acoustically ineffective. Architects also need to avoid sound-flanking paths from one room to another. Conduits, piping, and ducts that penetrate the walls and ceilings should be isolated from the portions by the use of resilient gaskets and caulking materials.

To control noise

Heating, ventilating, and air conditioning (HVAC) systems create noise, and noise in music buildings must be reduced as much as possible. Colleges can employ several strategies. They can place mechanical equipment in a remote location. They can use low air velocities, and reduce fan noise with in-line silencers and sound-absorbing duct lining. And they can provide silent supply and return grilles.

In studios and practice rooms, however, a low level of noise is actually desirable to mask the outside sound that inevitably seeps through wall, floor, and ceiling constructions. This low-level "acoustical perfume" can be done by installing a quiet air conditioning outlet or vent that generates and diffuses a moderate amount of continuous noise. This must be done very carefully so that the level of introduced noise is not objectionable.

Practice rooms need "acoustical perfume."

The design of the air conditioning system is crucial. A common misconception is that putting a silencer in the duct, or by lining the duct, noise problems caused by air conditioning will be solved. A silencer, by restricting air flow, regenerates noise itself. When a portion of duct length traverses a critical acoustical space, architects must encase the duct in serveral layers of gypsum board to prevent noise from breaking out of the thin sheetmetal duct enclosure.

To control noise there are several important design practices. One, never locate air conditioning equipment on the music building's roof. Instead, use a basement or a remote location. Two, support all mechanical equipment—chillers, pumps, fans, etc.—on vibration isolation devices; and for ducts, pipes, and conduits that serve the mechanical equipment attach them with flexible connections and suspend them on vibration isolators for a distance of at least 20 feet from each machine.

Three, place the supply and return ducts for teaching suites and practice rooms in the corridors outside the rooms. Branch ducts containing sound traps can then be tapped from the main duct into each practice room. This requires either wider corridors or taller plenum spaces over the corridors in which to stack the duct work. (See Figure 5.)

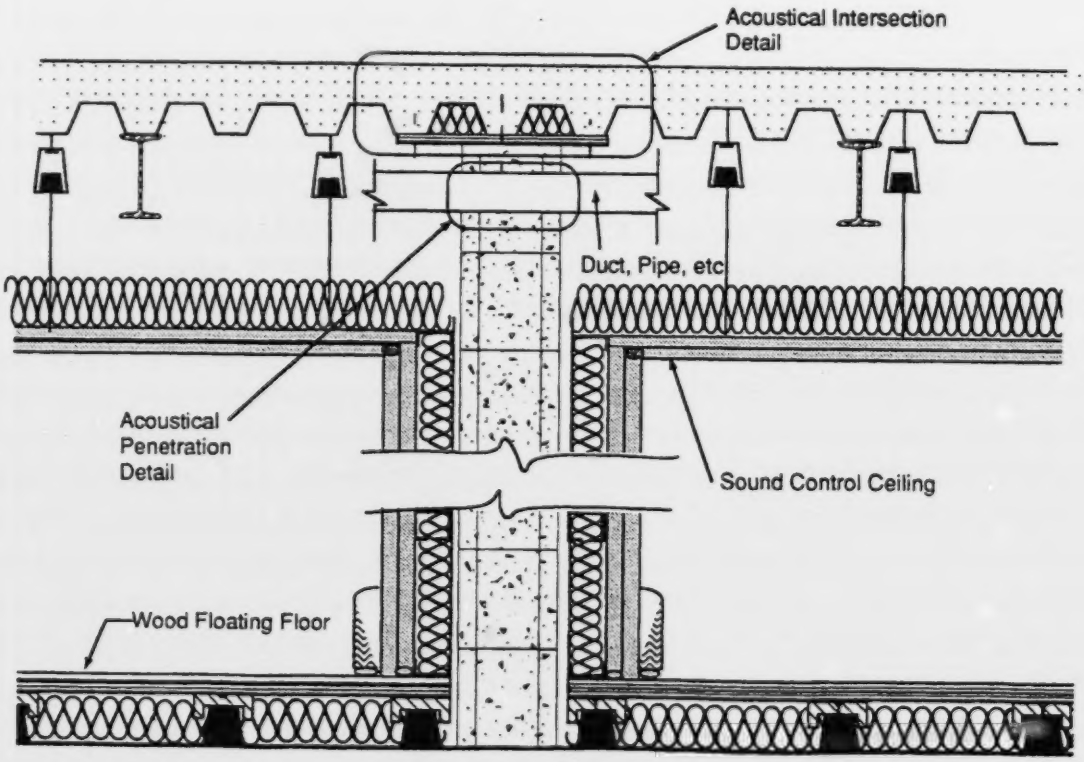
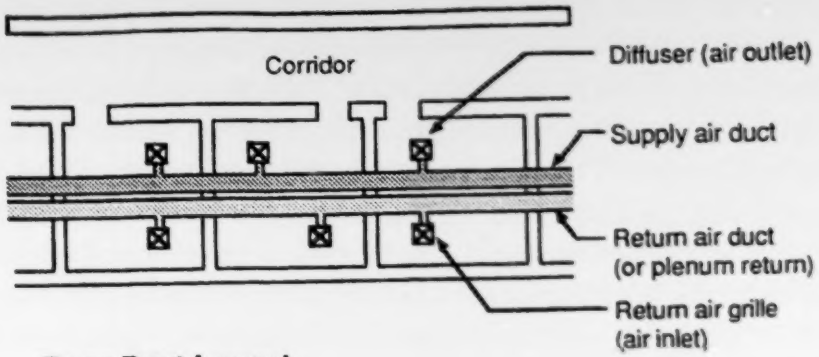
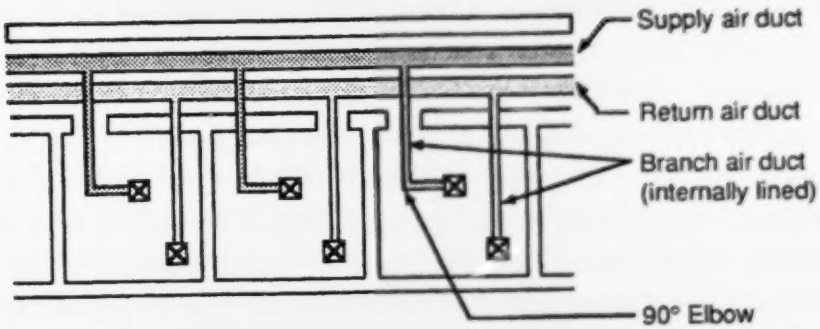


Figure 4. Studio and practice rooms require unusual sound insulation construction.



Poor Duct Layout



Improved Duct Layout

Figure 5. Air ducts for music practice rooms should be placed outside the rooms.

The matter of costs

What every college or university should remember is that music building costs are greater then most other buildings. Construction costs for music buildings in 1992 range from $125 to $135 per gross square foot, twice the construction costs of standard classroom buildings. Any architects and builders who come in with lower budgets should be questioned meticulously because they are probably making acoustical compromises and reducing the quality of sound and noise control.

Special attention should be given to the ratio of net to gross square foot. Music schools, with their complex and thick floor/wall/ceilings and large ducts and remote mechanical spaces, have larger grossing factors than standard construction. Whereas the standard construction grossing factor is 1.2, the figure for music buildings is 1.4 or 1.5. Colleges that accept low-bid estimates from builders who do not understand the special and expensive acoustical needs of music buildings will either receive poor-quality buildings acoustically or be forced to add money to the estimate to make late additions and changes.

Acoustical requirements raise costs way beyond those of other buildings.

I suggest that campus facilities planners submit a detailed, written description of the music building's sound isolation concept to the cost estimators at the beginning

of the project. It should include details about construction materials (double-layer gypsum stud wall, fiberglass batt, etc.) yet be generic enough to permit tuning of the partitions as the design develops. Such guidelines make it easier for estimators to judge costs correctly, and avoid surprises down the road. I believe it is wise to employ an acoustical expert for this early planning stage to help develop the sound isolation concept.

As I said at the beginning, music buildings are different. Universities must realize that structures in which to practice and perform the musical art require a high degree of advanced acoustical planning, specialized building design and construction, and above-average expenditures. ■

24

What you think about art can be very influential.

Art Buildings and Ideology

Graham Gund and Jonilla Dorsten

At various periods in their history, U.S. colleges and universities have selected some one building to make a statement. In earliest times it was the chapel. In the early 20th century it was often the library. After World War II it was frequently the science building or a student center. More recently it has tended to be sports arenas or arts centers.

That so many American colleges and universities have suddenly been improving their facilities for music, theater, and other arts, or building grand new arts centers, signifies that in our time art has achieved parity in higher education with history, science, law, economics, and religion. Indeed, some persons, like Tom Wolfe, have claimed that the arts constitute a "religion" of the late 20th century. Students travel to rock concerts, museums, and dramatic performances as pilgrims once traveled to Santiago de Compostella and still travel to Mecca.

It was not always that way. The arts were seldom taught at most colleges and universities until 70 or 80 years ago. Indeed, schools of architecture were the most recent of the professional schools on campus. In the 19th century it was often the student social clubs, such as Harvard's Hasty Pudding Club, which sponsored artistic activity. To this day the arts usually are most lively as extracurricular activities: the college orchestra, theatrical group, or chorus and the dance groups, film society, the artists club.

But recently the arts seem to have become a more important part of being an educated person, and institutions from 900-student Centre College in Kentucky to the huge state universities have built splendid new arts centers. Art seems to reflect the expressive individualism that scholars such as Robert Bellah and Charles Taylor have said is the dominant ethic of our time.

Two weighty questions

The movement of the arts to center stage in higher education, and the construction of new arts facilities, presents some important questions to campus planners and policymakers. We think two questions are especially crucial.

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Jonilla Dorsten is an associate with Graham Gund Associates. She is a graduate of the University of Virginia, where she also earned her M.Arch. degree.

One is the kind of building that is appropriate on campus for the arts. The American college has long been distinguished from its European ancestors by a campus planning tradition which more or less espouses the Jeffersonian notion of an "academical village," or a small town in microcosm (Turner 1984). And the physical form of the campus has often expressed the educational ideas of the president, leading professors, and trustees. So the ideological history of a college is usually embedded in its arrangements of architecture, grounds, and playing fields. For architects, therefore, issues of symbolism as well as functional issues of programming, space planning, and technology derive from a solid understanding of each institution's ideology and educational mission.

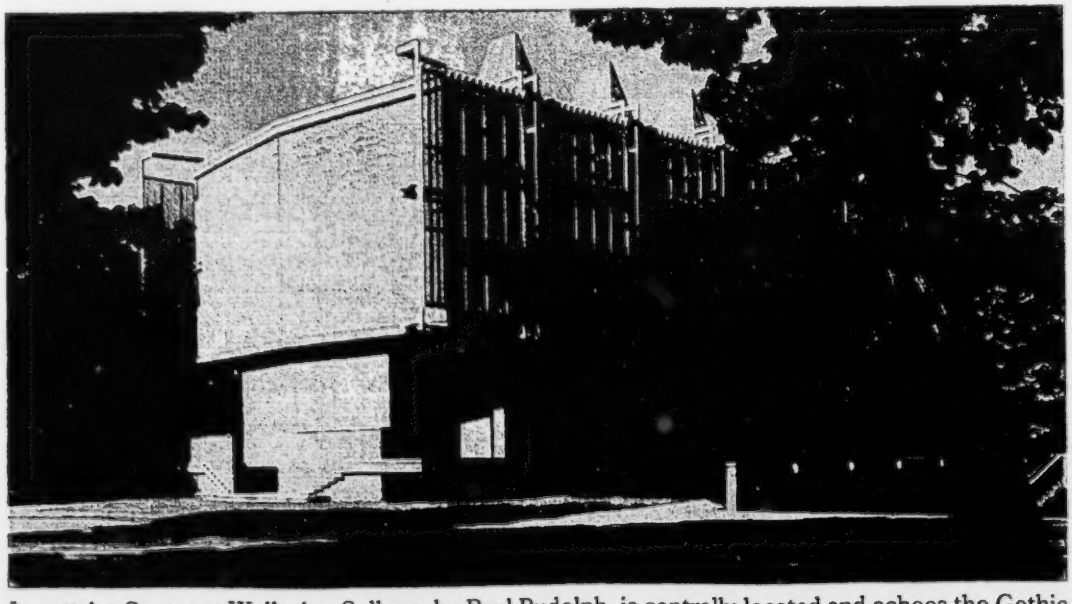
The ideology of a college is usually embedded in its architecture.

But what if an institution's ideology shifts? How should the buildings that reflect the new ideology relate to the older buildings that expressed the previous ideology? To put it differently, should art centers look like the rest of the buildings on campus, or should they signify a bold departure into a broader educational philosophy? Should the art building itself be a work of art, an architectural sculpture (Rybcynski 1993), or should it take its place quietly alongside the other disciplines of higher learning? The ideology of the campus plan is an important starting point for approaching the design of the college arts facility.

There is a second significant planning question. How does the university think about art? Is art just one of the liberal arts? Should students understand the history of art as a form of human expression, like literature or philosophy; or should they be taught to do art, to be provided the techniques that enable them to create art for themselves?

And what about the public? Art is a private act that has a public life. Often public discourse is an important part of the evolution of an artist. Galleries and theaters exist to expose art to the university community, or to the community surrounding the campus. What is the college's ideology about widespread public involvement in campus artistic activity?

So each college or university planner and his or her administrative colleagues—and the trustees—need to make some diffi-



Wayne Andrews/Esto

Jewett Art Center at Wellesley College, by Paul Rudolph, is centrally located and echoes the Gothic architecture of the campus in a contemporary way.

cult choices based both on the ideology of the traditional campus physical plan and on the beliefs they hold about the role of art in higher education.

To help with these choices, we offer six different solutions that may serve as the basis for exploring your college's own issues of siting, architectural expression, and function. Each case study reveals attitudes about the relation of the new arts building to the other buildings on campus and about the nature of arts education on campus. We hope the six case studies will provoke thought among planners so they can play a vital role in the design of the arts facility on their campus.

Jewett Arts Center, Wellesley College

Art at Wellesley is seen not only as a means of personal exploration and expression but also as one of the major academic journeys that give meaning to our world. So Wellesley needed an arts center that combined studios, practice rooms, and performing space with offices, a library, and lecture hall.

When architect Paul Rudolph was selected to design the Jewett Arts Center in 1958, he took note of Wellesley's views about the place of art in the college. But he also asked questions and made observations about Wellesley's campus planning traditions. He observed that the college's major buildings were sited on the hills of the gently rolling country of this Boston suburb, leaving the valleys in a natural state. He saw that the campus buildings were grouped in close clusters, forming courtyards and landscaped outer spaces. He found that most buildings had elaborate silhouettes, with the vertical lines of the college's collegiate gothic architecture emphasized.

Paul Rudolph and Wellesley's officials decided to locate the building on the south and west slopes of Norumbega Hill, the academic center of the campus. Thus, the Jewett Arts Center both completes the campus' main academic quadrangle and constitutes an edge element, serving as a gateway to the cluster of buildings on the crest of the hill. By building in accord with Wellesley's campus planning tradition, the college and the architect made a statement about the place of the arts at Wellesley: close to its academic core.

As the college wanted, Jewett houses the visual and performing arts and art library, and includes the departments of art history and music. This reflects the ideology at Wellesley that the arts are interconnected and interdependent, not neatly separated semi-disciplines. But while architect Paul Rudolph designed a single building, he organized it into three discrete forms, each of which houses different functions. A low music and drama unit consists of two stories of listening, practice, and office spaces wrapped around a central theater/auditorium. A higher visual arts unit contains workrooms, laboratory space, a library, and offices. The third unit is a gallery that bridges the performing arts and the visual arts. By separating the building into discrete forms, Rudolph not only organized it in a clear way, but isolated the unique structural, mechanical, and acoustical requirements of each function.

Carpenter Center is a workshop for making art.

Architecturally and ideologically, the Jewett Arts Center speaks to the college's campus planning tradition and to its view of the role of art in the education of talented women. As Paul Goldberger wrote in the July 31, 1994 *New York Times*:

> Jewett [is] the design in which Paul Rudolph managed to achieve what Eero Saarinen spent most of his career trying to do, which is to create a version of modernism that would be rich, textured, almost picturesque, and comfortable in its relationship to older buildings around it. Mr. Rudolph's art center sits beside the historic Gothic structures of Wellesley with comfort and ease.

Carpenter Center for the Visual Arts, Harvard

In contrast to the Jewett Arts Center, Harvard University's Carpenter Center for the Visual Arts (1963), designed by Le

Corbusier, places art slightly outside the educational mainstream. It tells us that the role of art on campus is to stand slightly outside and comment on society. Art should challenge our perceptions, shake us up. As D.H. Lawrence used to say, the role of the artist is to stand outside society and criticize it. Well, the Carpenter Center stands somewhat separate from Harvard's historic architectural community and announces to students and visitors that the place of the visual arts at Harvard is one of avant-garde exploration and visual comment. The French architect Le Corbusier probably also intended to have the visual arts comment on the over-verbalized and over-intellectualized society of leading American universities.

Rather than echo the tight orthogonal arrangement of formal Georgian buildings which line Harvard Yard, Le Corbusier built upon the diagonal walkways which slice through the campus quadrangles. (See Figure 1) A strong diagonal entry ramp cuts through the site and brings pedestrians up and into the heart of the building. (The ramp was originally conceived as a passageway through the building connecting Quincy Street to Prescott Street.) Thus, the outside becomes the inside and vice versa, in marked contrast to the adjacent Georgian boxes which clearly distinguish outside from inside, demonstrating how art can help us reconceptualize reality.

Le Corbusier, with Harvard's concurrence, designed Carpenter Center as a workshop for making art. The building's largely transparent shell and pedestrian-friendly entrances even expose the process to view. The building is a single volume of flexible space which accommodates a wide array of functions for the visual arts. It houses two and three-dimensional design, photography, and exhibition space with its free plan. A basement level houses the more static functions of lecture hall, light and communications workshop, and studios. The top floor is the visiting artist's studio. Le Corbusier exposed the building's mechanical system components to enhance the atmosphere of a factory-workshop.

Harvard's Carpenter Center embraces the act of making art. With its architecture it

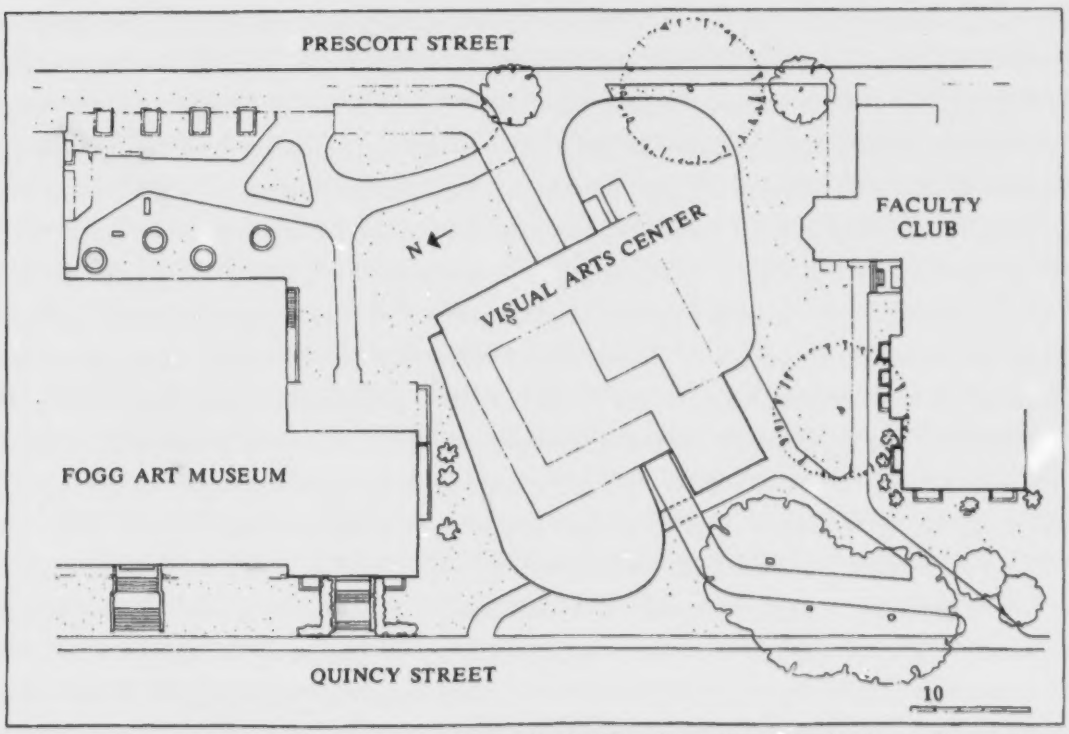


Figure 1. Harvard University's Carpenter Center for the Visual Arts, by Le Corbusier, is diagonal and different from its surroundings as if art itself is slightly outside the regular academic life.

separates itself from both the allied but more sedate worlds of art history and art criticism and from the intensely verbal and quantitative intellectual life of the rest of the campus. In fact, when Le Corbusier's building was finished, architectural critics compared the design of the center to such contemporary artistic movements as the "theatre of the absurd," abstract painting, earth sculptures, and avant-garde film making.

As a factory for making novel art, Carpenter Center presents an unpolished physical face to the public and the rest of academe, and seems intended to challenge and inspire, to engage and enrage—as modern art often does. The architect's neglect of Harvard's traditional campus planning and red-brick architecture is striking and probably intentional.

Carr's Hill Precinct Study, University of Virginia

In the late 1980s the University of Virginia decided to reinforce the position of the arts within their academic community. They commissioned Michael Dennis and Associates to conduct what was known as the Carr's Hill Precinct Study for the creation of a new "Acropolis for the Arts." The university hoped to expand the architecture and drama facilities already on campus, and add new facilities for music, dance, TV/film, and studio arts.

The Precinct is an area at the edge of the campus, giving the university an opportunity to establish a more public face for the arts, not only for the campus community but also for the people of Charlottesville. In effect, the University of Virginia desired three things: expanded facilities for the arts, closer collaboration among the various arts, and greater public presence.

Any architect who works at the University of Virginia can't help but be impressed immediately by Thomas Jefferson's orderly campus planning ideas. Michael Dennis was no exception. So his study suggested that new construction should create outdoor spaces and building arrangements to enhance Jefferson's idea of "an academical village." It integrates buildings and gardens, new and old. And by doing so, Dennis' study—completed in 1990—signified that the arts were now one of the fully valid academic pursuits at the University.

Dennis collected the variety of creative functions around a series of outdoor rooms with carpets of grass, much as Jefferson collected his pavilions around the long central lawn, each pavilion housing a different professor teaching a different subject. The artistic precinct thus underscores the idea that each of the arts are distinct but interrelated.

So far the Carr's Hill Precinct Study has not become a reality because of insufficient funds. But the project is similar to Wellesley's Jewett Art Center in the way it assembles the several arts in one place and in the way the architecture and planning respects and builds on the existing physical traditions of the campus. However, it differs in that it sits not in the interior of the campus but at its edge, offering to make the university's arts activities more open to the general public as well as to the university's faculty, students, and staff. But then, Wellesley College is a private college, while the University of Virginia is a taxpayer-supported, public state university.

Wexner Center, Ohio State University

Ohio State University is a public university too; it is also Ohio's land-grant university, which means it is obligated to help the people of the state grow intellectually and economically in useful ways. So when an affluent alumnus provided the funds, the university leaders chose to build a major arts center at the campus edge. Through a design competition, the university leaders selected a scheme which joined the campus grid with the grid of the city of Columbus, physically and symbolically linking the university campus with the wider context of the city beyond, and linking the university's arts with the people of Ohio and beyond.

And, just as its agricultural college and engineering school try to push forward the practical aspects of farming and technology, Ohio State's Wexner Center tries to push forward both artistic thought and the public's appreciation for art. So the building

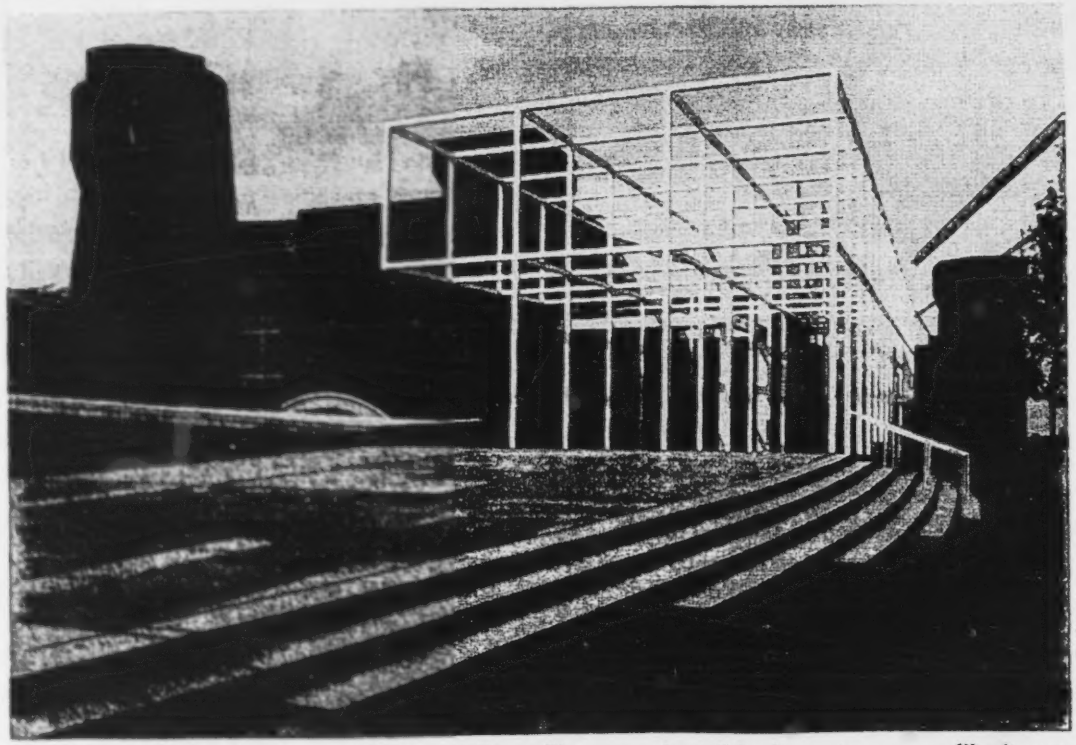
is primarily for contemporary and experimental art. It contains permanent, temporary, and experimental exhibition galleries, performance space, a black-box theater, a fine arts and graphics library, a film center, studio spaces, administrative offices, music practice rooms, a choral hall, and storage and prep areas. It also contains a public museum, a cafe, and an arts bookstore.

Clearly, by collecting all these arts in one place, Ohio State signals its belief that today's art is interdependent and symbiotic, and that citizens and students will find in the Wexner Center a complete picture of the evolving forms of the arts. The university selected as architects Peter Eisenman of New York and Trott & Bean of Columbus, Ohio as if to say we want an avant-garde building yet one that is appropriate for the citizens of Columbus and the rest of Ohio.

Somewhat like Harvard's Carpenter Center, the Wexner Center stands out and apart. It is strikingly contemporary, matching nothing else on campus. It also challenges classic building ideas in that it questions whether architecture should be shaped to human needs and respect local architectural traditions. With its surprises and inconveniences, it challenges functionalism and history. As Peter Eisenman has said, "Instead of symbolizing its function as shelter or as shelter for art, [the Wexner Center] acts as a symbol of art as process and idea and of the ever-changing nature of art and society" (Eisenman 1988).

Like art itself, the Wexner Center shakes us from the complacency of our convictions about campus master planning, traditional architecture, and notions of what art should be. The building is meant to function as a teaching tool about the role of art in society—as a creator and destroyer more than a preserver of knowledge and disseminator of research-grounded truths.

The Wexner Center seems to signify that the arts are a different kind of educator, tied to but not fully a part of the rest of the academic enterprise. The ideology of Ohio State University—that the arts are a bit different and should be more public than the search for



Ohio State University's Wexner Center, by Peter Eisenman, is strikingly contemporary like its art, and apart from the campus' main buildings.

better chemistry, soybeans, or political forms—is visible in this jaunty structure.

Frances Lehman Loeb Art Center, Vassar College

Vassar College has historically separated its studio art spaces from its art history classrooms and offices and the art gallery. And when the opportunity arose to build the Loeb Art Center, the college leaders made the decision to continue this tradition. The new Loeb Art Center (1993) therefore has only two functions: to provide the academic requirements of teaching art history and to allow for exhibits and a regional art museum for the upper Hudson River Valley.

The college commissioned architect Cesar Pelli to create a building which would have its own modern identity while being a part of the larger academic community and looking to be in scale and general appearance with the rest of the campus architecture. The Loeb Art Center was sited immediately to the right of the main entrance, as a gateway building along the most public edge of the Vassar campus. Architect Pelli kept the scale to that of an already existing building at the entrance to campus, a maintenance facility. Then the college gutted and renovated the old maintenance building, with its voluminous interior spaces, into studios for the making of art. So the Loeb Art Center, with its art gallery, library, art history classrooms, slide/photography study area, offices, and conservation and storage space, is now adjacent to a renovated studio facility, separate but proximate. The separation allows for structural, mechanical, and acoustical individuality while the proximity allows for a new arts complex at the gateway to the college.

Vassar's ideology appears to be that the study of art is now one of the major academic disciplines and deserves to be treated as such, and studio art is a relevant and increasingly important activity. Art is a creative activity; but so is poetry, scientific research, and historical interpretation. Art is part of, not outside and critical of, the rest of intellectual and creative life. Cesar Pelli's Frances Loeb Art Center expresses that attitude beautifully.

Visual Arts Center, Davidson College

Like Vassar's Loeb Art Center, Davidson College's new Visual Arts Center is situated at the primary entrance to the campus as a symbolic gateway, has a small regional gallery and museum for the public, and reflects the college leaders' goal to establish the visual arts as a major presence on campus but one that should take its place in the mainstream of academic life.

As architect of the Davidson Center, I examined 12 sites on campus before recommending the one that was chosen. With its

Like art itself, the Wexner Center shakes us.

simple temple form, red-brick skin, and expansive roof, the new building is firmly rooted in Davidson's tradition of strong, strictly ordered, neo-classical architecture; yet its imagery, scale, and proportions strike a balance between classical and contemporary-industrial languages.

Inside, the building creates a distinction between facilities for making art and those for presenting art. The public spaces, including a lecture hall and art gallery, are located near the main entrance, easy for visitors to find. Beyond the public spaces, the building becomes a factory for the making of art. Large, open studios line the perimeter walls of the first floor with facilities for etching, lithography, and sculpture, and for faculty offices while studios for painting line the second-story arcade. All these spaces surround a central atrium, which provides a lovely space where students, faculty, and visiting citizens can meet and converse. Somewhat similar to the courtyard at Wellesley's Jewett Center, the atrium provides a communal center for students of the various visual arts to converge, and the large interior space contrasts with the more rooted and disciplined exterior.

The building expresses Davidson College's view that art has become a more significant activity in academe. To remind the

college that it should be a place of imagination as well as reason, the college needs enchanters. Artists, to Davidson's leaders, are the enchanters on campus, the faculty and students who teach the meaning of color, metaphor, sound, and forms, who raise the possibility of other kinds of reasoning, who can create something not yet thought of.

About art buildings

Architecture can express ideas through built form and spatial relationships. It can reinforce existing ideologies or promote new ones. Therefore college and university planners and policymakers need to clarify for their architect what role the arts will play in their academic offerings during the coming decades. Should the academic study of art history and criticism be united with the creation of new art, or separate? Should all the arts be connected?

Other questions need pondering too. Should campus art activities be for the university or for the outside public too? Should art buildings themselves be iconoclastic works of art or should they fit in with the other buildings and maintain an affinity? In

A college needs enchanters.

sum, how should an art center express the campus ideology about the arts in academe and the ideas of the campus plan through the new building?

In our view, colleges and universities are built for the centuries. So college planners need to have a far-reaching vision, and eschew fads and exhibitionistic architecture. Yet art buildings require different forms. They demand lots of natural light and large spaces, a high level of taste, and a keen knowledge of the role of architecture within the realm of art. We also believe that single buildings on a campus should always

Jonathan Hillyer

The Visual Arts Center, by Graham Gund, at Davidson College is neo-classical to fit in with the other architecture and with the other liberal arts.

Jonathan Hillyer

Davidson's Visual Arts Center has a central atrium where students from the various arts can converge for discussion and social life.

strive to improve the spaces around them, so master plan concerns are vital. No building should be an isolated event.

The arts have arrived as a fervent new activity in American higher education. Architects can help with solid expressions of campus ideas and goals, and offer imaginative possibilities of what might be to college leaders. But only those in charge of the institution—planners, administrators, arts faculty, and knowledgeable alumni and trustees—can provide a vision of the place of the arts at their institution, which will ultimately shape the art buildings and spaces on their campus. ■

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They are increasingly popular and they are costly, but good planning can help.

Planning for Museums on Campus

Gail Dexter Lord and Margaret May

There are approximately 600 museums governed by public and private education institutions in the United States, the majority of which are operated by colleges and universities. Throughout the world, the institutions of higher education hold priceless art and specimen collections that are an irreplaceable record of human and natural history. Museums created for the purpose of preservation, education, or research have a long tradition as a part of academic life.

However, university museums have often suffered considerable neglect over the years. They are usually understaffed, underfunded, and underused. Sometimes they are housed in inadequate facilities where the collections are at risk. At the same time, we see new museums emerging on campuses and in society.

Half of all museums in the United States were founded after 1950. In Canada, the number of museums increased 280 percent between 1968 and 1990. Powerful trends are fueling the growth in museum attendance, which has increased enormously.

- The general population in North America has a higher level of education than ever before, and education is the single most important factor determining museum attendance.
- The baby boom generation is aging, and cultural participation increases through middle age. For the next 20 years museums will have the biggest, wealthiest, and best educated market ever.
- At a time when people have less leisure time and frequently diminished expandable income, museums offer choice, convenience, value for money, fascination, instruction, and a quality time experience.
- Families and women are an increasingly important segment of museum visitors.

Gail Dexter Lord is Co-founder and President of LORD Cultural Resources Planning & Management Inc., the leading museum and heritage planning firm, internationally. A graduate of the University of Toronto, Gail has had a distinguished career in the arts and cultural sector spanning 30 years. She addresses professional conferences and publishes extensively on the subject of planning for museum and the arts. Most recently, The Stationary Office, London, published *The Manual of Museum Management* (1996), co-authored by Gail Dexter Lord, and Barry Lord.

What should be the attitude of universities toward museums on campus? Do museums remain relevant in the computerized information age? Can universities afford them? Do they contribute to higher education, to institutional public relations?

Our answer is a conditional yes, if they are strategically planned. A successful campus museum should be well integrated in

A museum is above all a center of informal education.

the university's academic program and administrative structure, have a strong and accessible collection, offer programs to a wide audience, and be independently endowed or have a partner that contributes to the museum's operations. These strategies are being adopted by those planning the new Museum of Ceramic Art at Alfred University in New York and the University of Kentucky Basketball Museum, and by those positioning existing museums such as the University of Utah's Natural History Museum, within the university's new master plan.

Why a museum?

A museum is above all a center of informal education. It provides an opportunity for persons of all ages to engage in self-directed, inquiry-based learning. The real thing, object or specimen, remains at the core of that learning experience. Seeing trilobite fossils, a 12th-century Native American necklace, a Winslow Homer painting, or the domestic tools actually used by women settlers in 1850 is what fascinates. For university students, who are usually inundated by text and images, museums provide a unique opportunity to see the real object most people only read about, and to study it quietly up close.

On another level, the rapidity of change of the modern world and the growing complexity of life seem to lead many people to seek respite and stability in the past and to inquire about how we got to where we are. Understanding history is one

Visitors at the Museum of Ceramic Art at the New York State College of Ceramics at Alfred University in Alfred, New York. Powerful trends are fueling the growth in museum attendance.

of the central liberal arts; and museums help make human and natural history tangible, vivid, and memorable. Even photographs from 1910 of gray coated engineering students at their wood laboratory tables, female college students in loose blouses at their desks in a Latin class, or the school's bicycle team with their mustaches and knickers can arouse students to reflect on how college life and opportunities have changed. Museums help people to understand the world around them and help them to change.

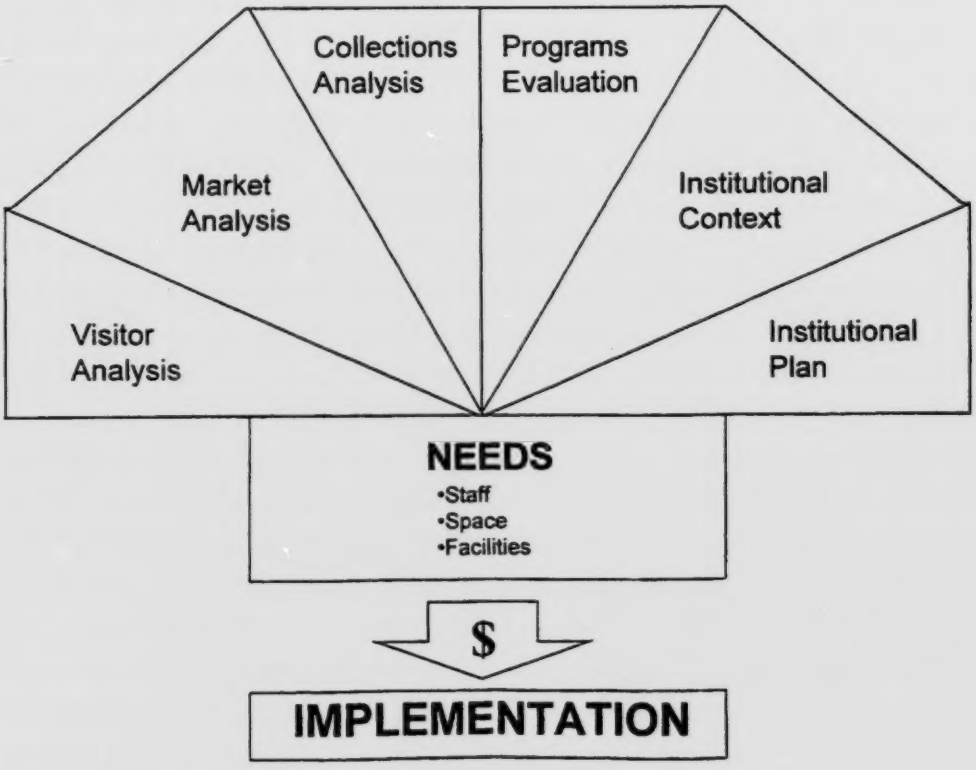
In addition, museums draw visitors to campus. Tourism is one of the world's largest industries, and cultural tourism—people visiting a locality to attend events and places of artistic, historical, or educational interest—is growing especially fast. Campus museums can attract visitors, potential students, and community residents.

However, the operating cost of a museum almost always exceeds the revenue stream. This is true even when the museum uses student volunteers and shared academic staff. A primary consideration therefore is adequate funding for the campus museum. The most successful university museums are those which are independently endowed or those which are operated in partnership with an outside agency, such as in the case of state museums on university grounds. Also, the museum's director needs to have an aggressive and persistent fundraising strategy to provide resources for the museum's exhibits, programs, and collections.

But good planning is crucial, whether a college or university is considering starting a museum, expanding a museum, or improving an existing museum. We believe there are six factors which should be considered in museum planning, and we have indicated these in Figure 1. The six may be understood as three pairs: museological factors, market factors, and institutional factors.

FIGURE 1

Factors in Museum Planning



Three for the show

Museological factors are primary. A good collection and attractive programs are vital in planning. The collection and how it is used—for display, study, or the education of viewers—is the heart of a museum. Many university collections were developed for purposes of study and may not be of display quality. Numerous items may be commemorative in their links to the university's history, and there will be decorative objects not considered works of art but worthy of display nonetheless. In addition, many colleges and universities have acquired papers, works of art, or special collections through donations. The collection must be evaluated to see if it is worthy of museum status.

Objects once used for didactic purposes now should be appraised for their historical or scientific value. For instance, the impetus for establishing the Museum of Ceramic Art at New York State's College of Ceramics at Alfred University was the recognition that the "study collection" composed of donations from the nationally renowned professors, graduate students, alumni, and ceramic artists that was assembled for teaching purposes needed to be properly cared for and made accessible to a wider audience. This is an example of the reevaluation of a collection, once seen as purely didactic but now considered of museum quality for its record of the development of American studio ceramics.

Universities should reexamine their historical and cultural assets. They may find significant works of art hanging in such places as the president's office, the faculty club, or the trustees meeting room. They may find historical apparatus stored in laboratory storerooms, field study collections boxed in the basement, or collegiate and sports team archives, trophies, photographs, and memorabilia stored in numerous places.

At the University of Toronto, a campus-wide art inventory revealed a sizable and significant collection of works of art. As a result, the curator of art suggested the need for a university art museum to provide for a center to care for and manage the collection. In addition, the museum can present outstanding works of art that require museum security. The University of Toronto's art museum plans to open in the spring of 1996.

The second museological factor is how the collection is to be used. Should objects merely be displayed? Or should there be instructive programs to explain the objects? It is through a museum's programs that the collection becomes a living and interactive educational force for the university's students and a powerful, informal cultural experience for the broader community.

A variety of program options may be considered, including visible or open storage, supervised study centers, portions of a collection which can be handled, as well as multimedia, on-line databases. The facilities designed for the museum should be appropriate to the museum programs, and should be flexible enough to accommodate new programming in the future.

A challenge for many campus museums is to strengthen the relationship with departmental faculty and the university's teaching program. This often requires that

The campus museum must establish a relationship with undergraduate and graduate programs.

the museum invest in defining new uses and values for its collections. The issues and research methods of the traditional disciplines most closely associated with museums—zoology, paleontology, anthropology, art history—have evolved with less focus on field and specimen/objects studies. Moreover, there is an increase in enrollment in professional and interdisciplinary programs and a decline in classical studies. Faculty are themselves less likely to be familiar with using objects/specimens as tools of inquiry. The campus museum must establish a relationship with undergraduate

and graduate programs and create new, cooperative, multidisciplinary opportunities for students to interact with the collections.

The museum itself can become a laboratory, a place of inquiry for students in education, community services, or other professional learning programs. Ideally the museum's professional staff should have cross-appointments to teaching positions and the supervision of graduate students. To fully achieve this potential, the museum requires facilities for staff offices, for graduate student and staff research and for lectures and meeting rooms.

For the outside public, great temporary exhibitions, informative lectures, and special events are fundamental to building a wider audience and repeat visits. Thus temporary exhibition space and areas for special events such as small concerts and lectures are vital.

The second set of factors concerns the market for campus and other visitors. With museums, especially university museums, the philosophy of "build it and they will come" does not sustain an audience. Though there were 566 million museum visits in the United States in 1988 (the last year for which numbers are available), the average annual attendance level at museums governed by public education institutions was only 28,431. When planning a new museum or expanding a small museum, a full market analysis should be conducted which considers the demographics and psychographics of the campus community, the region, and possible tourist markets.

At the core of market analysis lies the question, "Who is the museum to serve?" Some campus museums may seem to serve a special audience of, say, persons interested in biblical archaeology, the history of musical instruments, African culture, birds, or contemporary art. But even museums with specialized collections can be developed to appeal to all segments of the campus as well as to the broader public.

For example, the Utah Museum of Natural History has a statewide role so the University of Utah, in expanding its existing museum, has planned for a site, a community educational role, and family accommodations to serve its statewide clientele. In Lexington, Kentucky, where we have worked with the University of Kentucky on its Basketball Museum, it became apparent that UK basketball was such a part of the city's and region's culture that a downtown site (where the team plays) rather than an on-campus site for the museum was best. So the UK Basketball Museum is currently being developed as an interactive museum by a non-profit organization in partnership with the university. A campus museum can be a valuable bridge between town and gown.

They provide tangible proof of the multicultural life of this earth and the forms of nature.

Three factors seem to be especially influential in drawing people into a campus museum. One is *location*. The museum's siting, accessibility, proximity to parking and transportation, and perceived safety are critical to attracting visitors. A second is *exhibitry*. It is not the size or architecture of the museum that attracts people and builds repeat visits, but rather the quality of the visitor experience inside the building. This can be a problem for colleges and universities because more highly educated citizens are expecting very high quality, interactive exhibits, scholarly educational experiences, and high-tech ingredients, but universities typically have lower-than-average budgets for museum programs and exhibits. Planning for adequate resources for high-quality exhibits and accompanying programs is essential.

Third is *customer service attitude*. Planning should arrange for operating hours that respond to visitor's needs and not for hours that the college finds convenient. And the campus museum must be welcoming with friendly and helpful personnel, amenities, and thoughtful arrangements for families, senior citizens, and bus tours.

Those institutional factors

The third set of planning factors—how the campus museum fits into the college's life and its master plan—are those most often taken for granted. Yet the museum's mission, status, and organizational structure, and relations with the university, outside agencies, and possible donors directly affect the scale and nature of the museum's operations.

A very important planning issue for campus museums is ensuring a solid governance and administrative structure that serves both the university and the museum. Few campus museums are separately incorporated but most have advisory boards, which we think provide guidance and important links. Another important issue is the museum's relation to other institutions, organizations, or off-campus funders. These connections can often spark excellent exhibitions; for example, an Asian anthropology museum may team up with a foreign embassy to assemble an exhibit of that country's oldest textiles. Such connections not only strengthen the campus museum but also broaden the museum's outside audience.

Campus museums require adequate facilities, staff, space, and financial support. Often they require a subsidy, and university funds seem especially limited these days. But museums allow students, faculty, and visitors a unique opportunity to see and study rare and historically or artistically valuable objects made by people throughout the ages up close and in their material reality. They can provide tangible proof of the multicultural life of this earth and the infinite variety and forms of nature. Campus museums can inspire, educate, and cause persons to marvel and understand.

But like a great science building, library, or sports facility on campus, the college or university's museum requires excellent planning and a clear vision of the museum's role on campus. ■

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BOOK REVIEW

Planning for Performing Arts Centers

Building for the Performing Arts: A Design and Development Guide, by Ian Appleton. Butterworth Press, 1996. 225 pages. ISBN 0-7506-1276-2.

Reviewed by Richard Pilbrow

The cover picture of this new book by English theatre architect Ian Appleton is a striking example of performing arts architecture: the interior of Roy Thompson Hall in Toronto, Canada. Sadly, it is also a photograph of a poorly designed concert hall. Indifferent acoustics have brought on recent moves to remodel the interior; and the celebrated "architectural purity" of the hall has caused complaints of sterility from audiences and performers. A curious symbol for the cover of this book!

Building for the Performing Arts is a modern version of Roderick Ham's *Theatres: Planning Guidance for Design and Adaptation* (1987). That book pulled together several papers from the Association of British Theatre Technicians on many aspects of theatre design, alerting theatre people to the dangers of unfettered architecture and laying down some ground rules for the future. Appleton's new book restates some of these now-established rules, and widens the field to include some newer categories of performances such as jazz and rock and roll concerts.

The book contains many sensible suggestions for anyone contemplating the construction or renovation of a performing arts building. It writes of how to structure committees, to arrange the design process, and to design the project. There are lots of black-and-white illustrations, although the captions are sometimes too long and hard to read. It is unfortunate that at least some of the photographs could not have been in color to show us the real character of the rooms portrayed.

Ian Appleton correctly begins by reminding readers of the complexity of designing performing arts buildings. These halls must often host such diverse activities as music, drama, dance, puppetry, and lectures. Each activity has its own traditions and each is in a state of continual evolution. Each makes very differing demands upon the building, with the stage and auditorium as its instrument for performance. Therein

Richard Pilbrow is chairman of Theatre Projects, a leading consulting firm for theatre design, based in Ridgefield, Connecticut. He is also a theatre, film, and television producer, and a noted stage lighting designer who has done the lighting for numerous Broadway shows. Born and educated in London, England, he has been theatre consultant for such projects as the National Theatre of Great Britain, the Royal Opera House, Chicago's Goodman Theatre, and the Portland (Oregon) Center for the Performing Arts, as well as for several colleges and universities. His new book, *Stage Lighting Design*, will be published in early 1997.

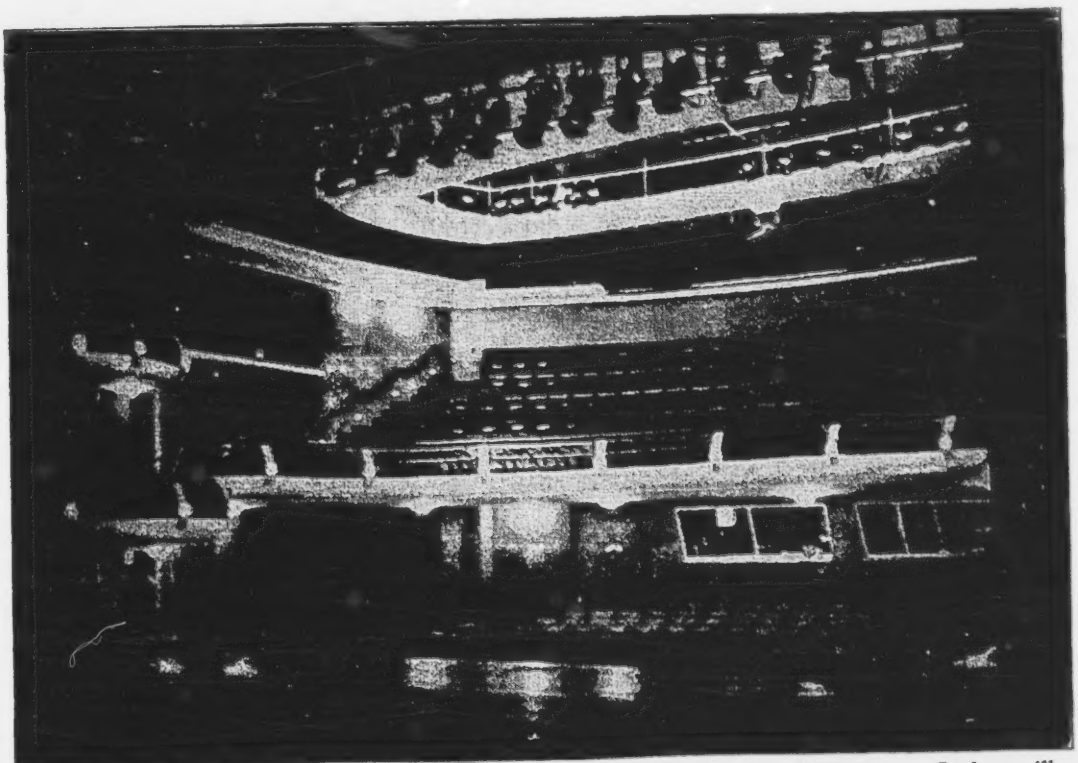
likes the complexity. The design of space for live performances demands an extraordinary sensibility from the design team.

There are far too many poor modern theatres and concert halls. Ask any performer or knowledgeable members of the audience to name their favorite theatres, and few will name any modern space. It is the historic theatres and concert halls that exert the strongest emotional hold. Modern arts centers may be more spacious, with better facilities and state-of-the-art acoustics and equipment, but they often fail to satisfy. Why?

Live performance, particularly in an increasingly electronic world, requires an environment that emphasizes the unique liveliness of the occasion. Live performance is not just looking and listening to the performer; it is joining in, participating in the event. A good theatre enhances an almost mystical communion between the performer and every individual in the audience. This communion requires a special environment characterized by human scale and intimacy, and by the clustering of the audience in a tight, three-dimensional relationship around the performance.

At the heart of *Building for the Performing Arts* are the "Specific Studies" which examine the many details of a performing arts building. These set out the rules that can guide site planning, stage and auditorium design, and the planning of public and backstage areas. It is written by an architect, and mainly intended for other architects. Now rules are rules, but some can be bent. This book offers useful check lists, but they need interpretation by those who know the arts of performance and their practice intimately. An architect armed only with these guidelines might be in the position of having only a little knowledge and being dangerous.

For example, Appleton describes the proscenium theatre as one in which "the performance is seen through a 'window' or hole in the wall and there is a clear division between audience and performer." Only in



The main theatre of the Nathan Wilson Center for the Arts, Florida Community College at Jacksonville. The 530-seat theatre has no seat farther than 70 feet from the stage. The consultant was Theatre Projects Consultants of Connecticut.

the late 19th and early 20th centuries was this true. It is now clear that the cinema and television close-up have eroded the notion of the proscenium as a barrier. The stage must now assume again its original role—that of being a bridge between the performers and the audience.

The performers need to have a close relationship with every spectator.

The plans of theatres and performing arts halls alone give little idea of their quality. It is the three-dimensional shaping of the large room around the live three-dimensional performer that is what theatre and concert hall design is all about. Appleton refers to the "benefits" of a single tier in auditorium design. Today many believe there are almost none. The performers need to have a close relationship with every spectator.

Drama, music, dance, and storytelling involve the creation of magic. Iain Appleton's book ably discusses the skeletal issues of theatre design, but for the creation of lively space, which alone can restore the impact of live performance in modern society, we must go beyond the architectural essentials in quest of the indescribable magic of live performance.

This is especially important for college and university performing arts centers because young persons who are not experienced professionals have an even greater need for intimate, embracing halls to support their creative efforts. Campus planners and architects will find this book useful but insufficient for making great campus rooms for theatre, music, or dance. ■

III. Instructional Spaces

Why colleges must renovate their classrooms, and how it should be done.

Classrooms for the 21st Century

Michael Owu

During the past 20 years or so the mix of large lecture rooms, small seminar rooms, and medium-sized classrooms has changed. Professors and students now want to be closer to each other during instruction. Dependence on a chalkboard is being replaced by new audio-visual techniques using film, computer projection, and slide projectors. We now know more about acoustics and lighting. New furniture designs have changed the way we sit. Yet many classrooms in America's colleges and universities were built 35 or 70 years ago and have changed relatively little. Colleges seldom budget for classroom renovations on a regular basis.

The typical undergraduate spends as many as 400 hours a year in classrooms. Of course learning also occurs in faculty offices, but the rooms where students meet with their teachers are central to effective instruction and higher learning. College classrooms deserve more than a half-century-old chalkboard and two dozen old wooden chairs on a bare floor. The time has come to convert antiquated classrooms into warm, attractive arenas that maximize student growth. Modernizing America's college classrooms may be one of the top priorities of the next decade.

Classrooms should be carefully designed to support the teaching style of the better instructors and to reduce distractions to a minimum. Good chalkboards are important, but so are the size and shape of the room, the lighting, the color of the finishes, the sight lines to the board and projection screen, the floor covering, and several other elements. The state of knowledge about classroom design has recently reached a point where campus planners can now assist professors substantially in their teaching efforts.

How can educational planners help institutions modernize their classrooms? After preparing for such renovations at my institution (MIT) and researching the subject for years, I believe there is a seven-step strategy that planners should follow.

1. Conduct a survey and inventory of all teaching spaces.
2. Carry out a utilization study to evaluate how classrooms are currently used, and how they match current teaching requirements.
3. Assess faculty and student requirements and their preferences through interviews and questionnaires.

Michael Owu is a senior planning officer at the Massachusetts Institute of Technology. A graduate of MIT, he has been responsible for administering MIT's classroom renovation program.
The author thanks his colleague, Julia Vindasius, who assisted in developing MIT's assessment and procedure.

4. Develop the design criteria for seminars, classrooms, and lecture halls.
5. Calculate estimates for the costs of renovating each of the rooms.
6. Devise a program of renovation, with a financially realistic sequence of improvements.
7. Review regularly the teaching styles, specific program and course enrollments, and college teaching policies to monitor changes in classroom needs on campus.

The classroom inventory

The first step is to conduct a physical survey which counts, measures, and evaluates the physical elements of each teaching space. The survey should include room dimensions, finishes, furniture, room arrangements, conventional equipment, utilities, lighting, window treatment, ventilation, noise level, safety features, and audio-visual equipment.

In addition to these objective measurements, it is useful to assign a rating to each space as a guide to measuring the overall quality of the classroom. In a survey conducted at MIT (Vindasius 1987), a rating scale of 1 to 5 was used, with the worst rooms for teaching rate 1, the best 5. MIT's survey revealed that 66 percent of the 154 general-purpose teaching spaces were rated 3 or below (Figure 1). Most of the worst classrooms were located in buildings built between 1913 and 1937. Most commonly, these classrooms were characterized by a stark, half-century-old environment, with poor lighting, old chalkboards, unsightly finishes, and HVAC systems that were worn, broken, and/or shabby in appearance. But even classrooms built more recently lacked the attention to detail required for effective teaching.

The typical undergraduate spends as many as 400 hours a year in classrooms.

How are the rooms used?

The next step is to conduct a utilization study. Such a study measures the degree to which classrooms are actually used compared to

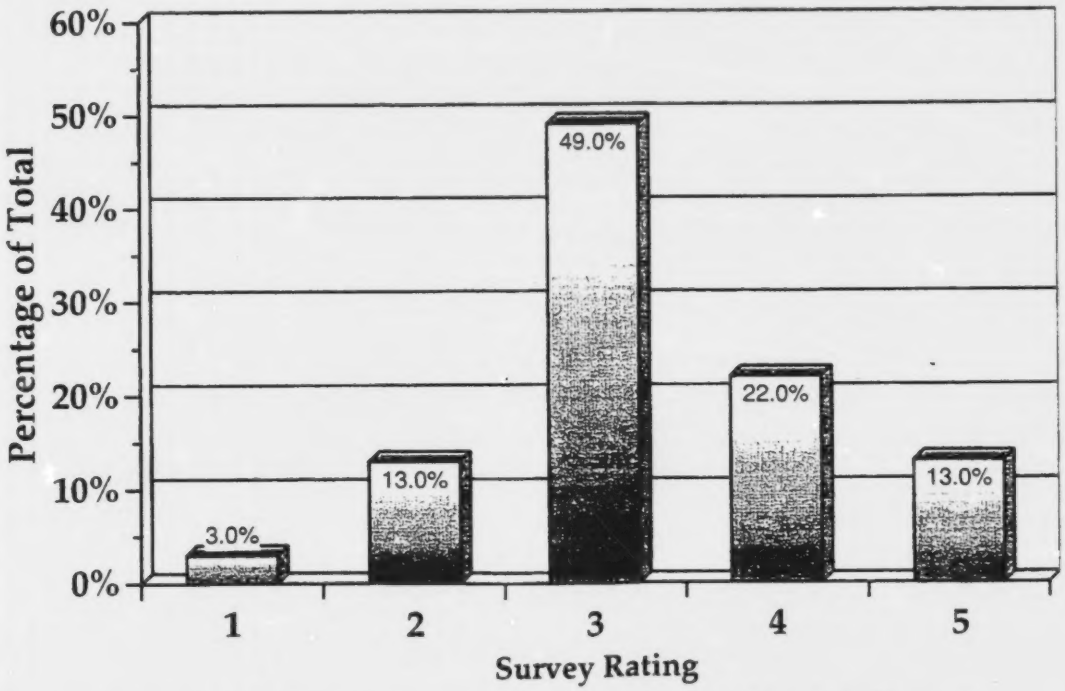


Figure 1. In MIT's classroom survey, 66 percent of the rooms rated 3 or below in quality.

their total possible use. (WICHE has issued a useful manual for calculating classroom utilization rates.) Three indicators should be measured:

- *Scheduling*, which describes the hours in use as a percentage of a 40-hour week;
- *Net utilization*, which describes the initially-assigned occupancy as a percentage of the total capacity of each room;
- *Fullness*, which portrays how "full" a room is when is it occupied by students.

You need to be careful in interpreting the results of the utilization study. You will probably find utilization to be surprisingly low, as we did at MIT. This has several causes. One is the presence of limited-use classrooms such as science laboratories, engineering classrooms, architecture studios, and machine-filled rooms for technology courses.

Classroom design has reached a point where planners can now assist professors.

Another cause is that most faculty prefer teaching in the middle of the day, between 10 a.m. and 3 p.m. and universities often cater to faculty preferences. Also, colleges with an abundance of elective courses are likely to have a low rate of room utilization. And, classrooms located in remote areas and those in very poor condition are likely to be underutilized. Faculty will be reluctant to teach there, and students will not want to attend classes there.

What we found at MIT was that we had too many large classrooms and too few smaller seminar rooms for the mix of courses taught at MIT today. Specifically, half the course-hours taught were in seminar-sized classes with enrollments of fewer than 20 people. Yet only 16 percent of the Institute's classrooms were seminar rooms for 20 or so students. At the other end, nearly one-third of the Institute's classrooms seated 40 to 60 students whereas only 7 percent of our course hours had enrollments of 40 to 60 students.

Generally, there has been a trend to smaller classes in U.S. higher education in the past few decades. However, this trend could be reversed in the 1990s and beyond as very tight finances force colleges to reverse the tendency toward course proliferation and highly specialized, boutique courses with tiny enrollments.

We found we had too many large classrooms and too few smaller seminar rooms.

Interviewing for preferences

The third step is to interview faculty members and students as well as asking them to respond to questions about classroom preferences through conventional survey instruments. Interviews at MIT revealed that both faculty and students had a strong interest in creating warmer, more intimate, and more attractive classroom spaces that promote faculty-student exchanges.

Interviews at other colleges and universities may reveal a desire for terraced lecture halls, better audio-visual equipment, elimination of the pale green walls that seem to be prevalent at some campuses, better chairs, more evening classes, improved display boards, and carpeted, attractive seminar rooms that encourage lively discussions.

Designing tomorrow's classrooms

Fourth, your college will need to develop criteria for the design and renovation of classrooms and lecture halls. This is a very important step that will most likely determine the learning environment for your institution for the next half century.

You will need to display a balance in the design criteria. On the one hand a number of standards can be used as a starting point, such as those employed at the University of California, Santa Cruz (Brase 1988), or Pennsylvania State University (Allen 1991). And architectural experts on office, restaurant,

and school design might be consulted. On the other hand, each college or university needs to create its own standards that reflect the needs and preferences of its own faculty, students, and administrators and the institution's traditions and financial ability to make changes.

I believe that classroom design should be grouped into four categories: physical considerations, environmental factors, furniture, and audio-visual equipment.

Each of the four categories of design criteria should satisfy the following four design requirements.

Function. The classroom must be able to function effectively for the type of instruction to be carried out within its walls. A classroom used to teach physics needs to accommodate live demonstrations whereas a classroom used for music performance must have a completely different set of criteria. A general purpose classroom has to be able to satisfy a range of teaching styles.

Focus. The room should focus the student's attention on the instructor, screen, and presentation area. A focused room makes it easier for teachers to convey information, communicate energy and enthusiasm, and elicit questions and challenges. Focus is achieved through an arrangement of architectural elements, proper acoustics and lighting, and the absence of visual distractions.

Flexibility. Because many classrooms have multiple uses, they must be flexible enough to seat 50 students while making a 20-student class seem comfortable in the same room. And most classrooms need to permit lectures as well as slide presentations with note taking. Flexibility is also necessary to accommodate changes in the technology of teaching over the next 20–30 years.

Aesthetics. Attention to aesthetics allows students to enjoy their classroom encounters, and feel like learning. Attractive classrooms lend dignity to the learning process, and announce silently that the cultivation of the mind is a beautiful and dramatic activity. Mean and dingy classrooms—especially if the athletic facilities and art center are handsome—suggest that classroom teaching is a lesser enterprise. Attention to form, line, color, texture, and variety can be achieved at relatively little additional cost and a tremendous return on the investment.

With these design requirements in mind, planners can work on the four categories of classroom design.

First, physical considerations. Faculty members need to engage students; so raised platforms for the teachers should be avoided, even in the largest lecture halls. Instructional space should be level, or below that of the students.

To improve sight lines and sound transmission, floors should be tiered in all the larger lecture halls. Light-frame construction can be used to build over existing flat floors usually. Ceilings should be not less than ten feet high, and should be angled at the front of the room to better project sound to the rear (Figure 2).

Mean and dingy classrooms suggest that teaching is a lesser enterprise.

Entrance doors should always be located at the rear of the room, not at the front where latecomers can disturb the class in progress. Vision or see-through panels should be installed in all doors to allow students to check whether they have the right class or whether the classroom is in use. The vision panels should be narrow to reduce the spillage of light from the hallway lights during video shows in class. If the doorway cannot be relocated, it may be necessary to reorient the room 90 or 180 degrees during renovations.

Second, environmental factors. Acoustics and lighting have an enormous influence on the classroom experience, but are often neglected in the design of classrooms. Good acoustic design must control the sounds and voices in the room so that they are heard easily and accurately, and it must prevent unwanted background or outside noise from intruding.

In small classrooms modest acoustic treatment may be required. But in medium-sized and larger classrooms good acoustics

probably require the introduction of tapered side walls and an angled front wall (Figure 3). There should be acoustically reflective surfaces at the front of the room and acoustically absorbent surfaces at the rear.

The importance of lighting in classrooms cannot be overemphasized.

In rooms of any size, I strongly recommend carpeting to absorb unwanted sounds such as the sound of chairs being moved or feet being shuffled. Anti-static carpeting should be used in rooms that use equipment with magnetic tape and memory. Other sources of unwanted noise—squeaky chair arms, rattling windows—should be identified and fixed or replaced.

As for lighting, its importance for classrooms cannot be overemphasized. Most classrooms at U.S. colleges and universities are lighted horribly, with a few blue-white fluorescent panels stuck up on the ceiling. With the desire by faculty and students for a warmer atmosphere and the increased use of overhead, slide, video, and computer projection during classes, classroom lighting design needs far greater attention.

Most important, each student's ability to take notes needs to be maintained at all times. (A light-level of two foot-candles is sufficient for college students.) The best way to achieve this is by using incandescent downlights which can be dimmed over the entire seating area, and a series of additional fixtures for general purpose lighting, chalkboard lighting up front, podium lighting, and special instructional space lighting as needed. A set of incandescent lights over the instructor's area should illumine the chalkboard or science presentation tables. If fluorescent fixtures are used, soft-white bulbs should be used. Recessed fixtures are preferable, and fixtures should be placed at the periphery of rooms as well as at the ceiling center.

Almost as important as the lighting are the lighting controls.

Controls should be simple to use, very clearly labeled, and conveniently located. Usu-

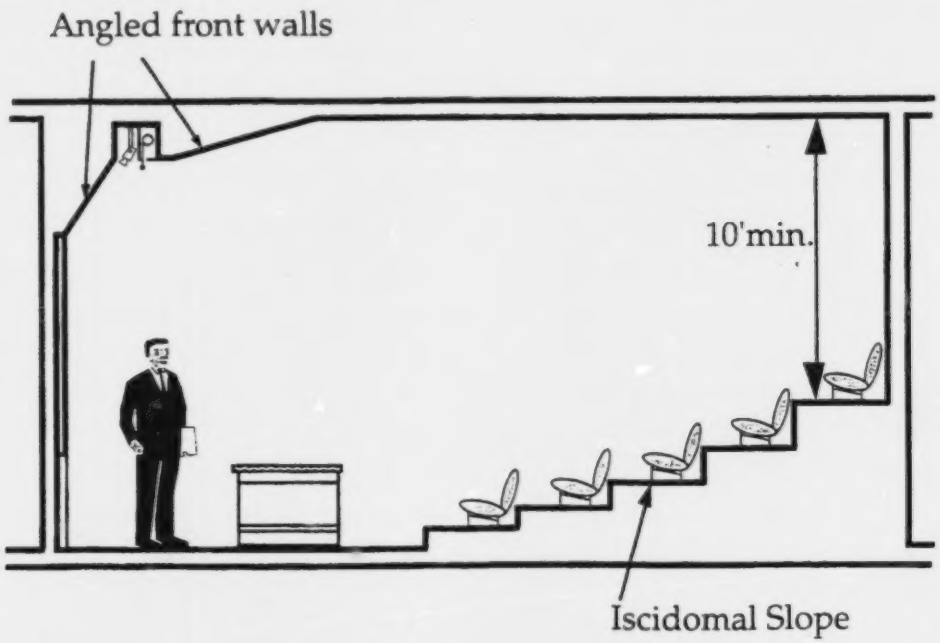


Figure 2. Research is revealing the ideal classroom design.

ally, controls should be located at room entrance (at the rear), in the projection booth if there is one, and at the instructional space in the front of the room so that the teacher can adjust the lighting. Also, light from outside the room needs to be controlled. Sunlight spilling into the room can wash out projected images, so blackout shades or blinds are imperative.

Then there is the need to control heating and cooling to make students comfortable. Thermostats in the classrooms should keep temperatures at 65–68°F in winter and at 72–74°F in summer. Humidity levels should, if possible, be maintained at close to 50 percent. If there are windows, they should be capable of being opened in spring and fall.

Third, the furniture. I think a college is wise to invest in durable, high-quality furnishings rather than cheaper, plastic chairs and metal tables. Initial costs will be higher, but the payoff in wear, comfort, and aesthetics makes better furniture a smarter choice for the long run.

For larger lecture halls (and even smaller ones) and for seminar rooms, continuous writing surfaces for the students should be used. Tables provide students with more room to spread out their materials and are more suitable for open-book examinations. In seminar rooms, oval tables are the most effective. In lecture halls, the tables should be arranged in long concentric arcs facing the instructor, and fixed, upholstered tilt-swivel chairs should be used behind the curved tables. In smaller classrooms or seminar rooms, however, fixed seating is a deterrent to group activity and flexible use. In medium classrooms tablet-arm chairs are almost obligatory, but the chairs should be upholstered and tablets should be large (at least 130-square-inches in size). A minimum seat of 21 inches should be specified. And several

Chairs should be upholstered and writing arms should be at least 130-square-inches.

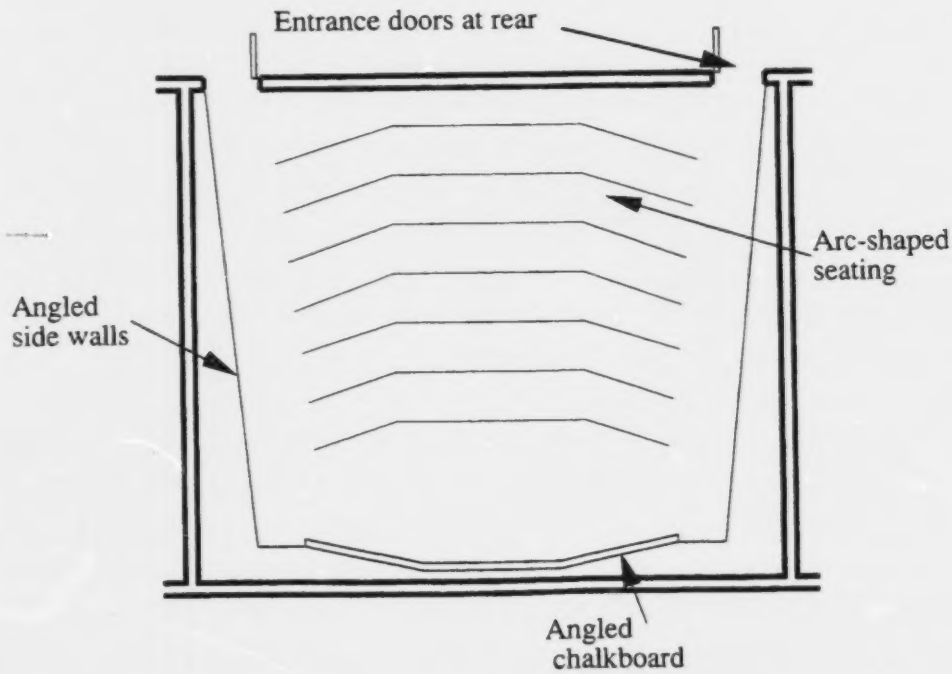


Figure 3. Entry, acoustics, and lighting are very important.

tablet-arm chairs for left-handed students should be in each classroom with movable chairs. The wheeled chairs should have book storage under the seats.

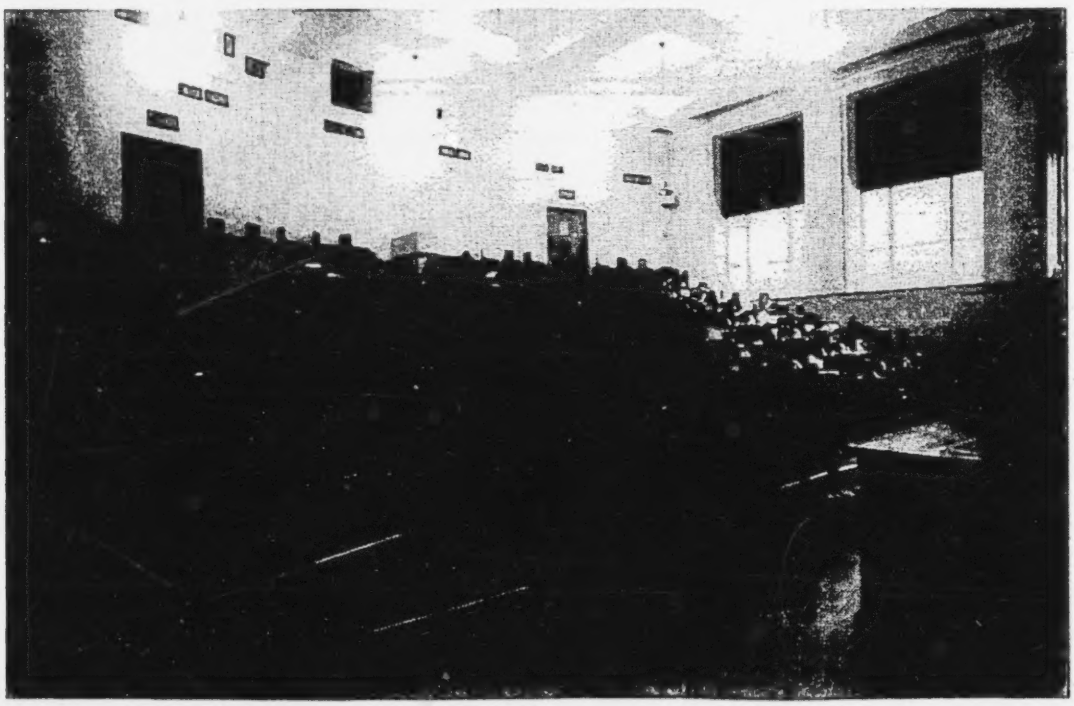
Chalkboards should be black for contrast; brown and green chalkboards should be shunned. Preferably the board should be ample, covering most of the forward wall with panels four feet high. In large lecture halls motorized chalkboards, with manual overrides, should be installed. Where audio-visual equipment or computers are used extensively it is better to install white marker boards with water-based markers.

Classrooms also should have a bulletin board near the entrances-exits, and have coat racks where students can hang their coats during class. Unobtrusive, lockable, built-in storage units, with cabinets and drawers, should be present in most classrooms so that overhead projectors, television sets with VCRs, or science equipment can be secured after class.

Fourth, there is the matter of audio-visual equipment, which is increasing rapidly in classrooms presentations. Designers might begin by reading a good book to become familiar with the latest technology, such as that by Jerome Menell (1982) or Robert Simpson (1987). For large lecture halls it is prudent to consult an audio-visual specialist early in your renovations.

There are four types of projectors that are being used currently in classrooms: overhead projectors, slide projectors (35 mm and lantern), movie projectors (16 mm, 35 mm, and 70 mm), and large-screen display systems capable of receiving signals from television, videotapes, laserdiscs, and computers. There are also two projection methods: front-screen, where audience and projector are on the same side of an opaque screen; and rear-screen, where audience and projector are on opposite sides of a rigid, translucent screen. With this complexity, you can understand why an audio-visual specialist is required.

The relationships between screen height, distance to the first row and last row of seats, and optimal viewing angles are all well established for traditional projection methods. But these are based on assumptions about the minimum size of the pictorial image and text. For text displayed from a computer source, however, those same assumptions cannot be



MIT's Boynton Hall, 1968.

accepted because computer text is small and difficult to read.

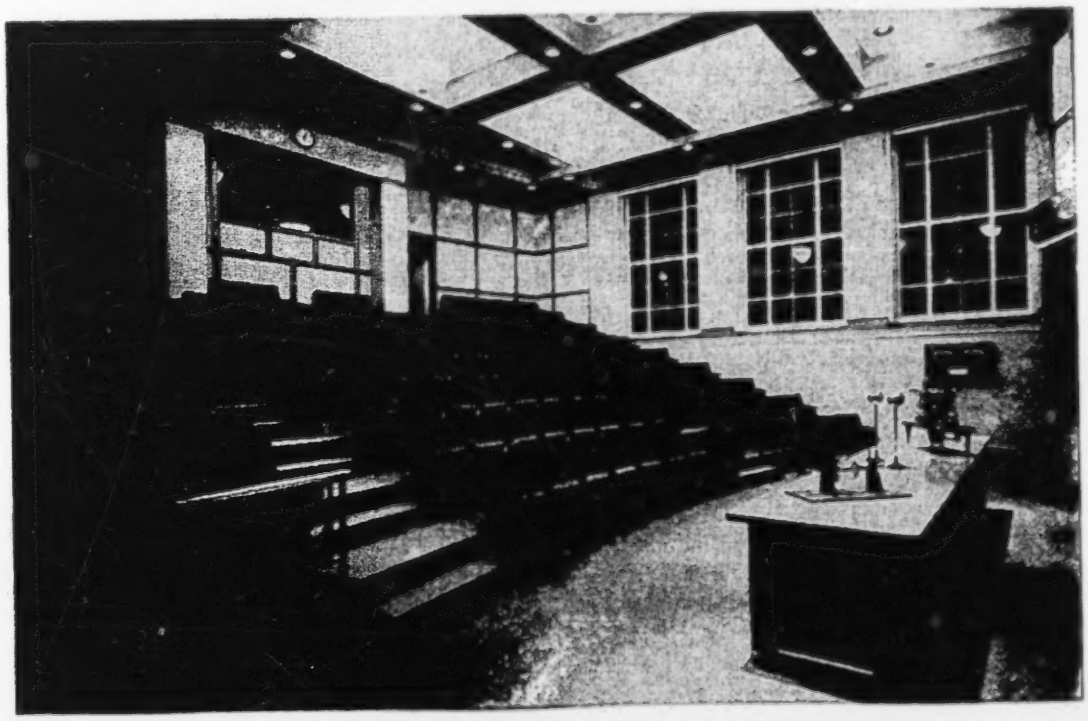
Computer technology is changing so fast the equipment installed today may well be obsolete in 3–5 years. Planning for that day is challenging; no one can be certain in what direction the industry is moving. But it is wise to accommodate the technological innovations and maintain flexibility by building wiring conduits that can handle future connectivity to cable, computer networks, or an ISDN telephone system.

How much will the changes cost?

The fifth step of the classroom modernization strategy is to develop cost estimates. These estimates are extremely difficult without specific architectural plans and actual rough estimates before they approve substantial classroom renovations. So you need to generate some general costs per square foot for categories of space rather than for individual classroom space. For example, you can use one cost per square foot for all classrooms from 200 to 400 square feet in area, and another for rooms in the 400 to 600 square feet range, rounding the costs out to the nearest $10,000.

Classroom renovation, especially of older classrooms, is seldom inexpensive. For example, at MIT we renovated a 150-seat, 1500-square-foot lecture room that had not received attention since 1933, and that had been described by one faculty member as a "travesty," into a beautiful, paneled, ultra-modern, 21st-century award-winning lecture hall at a cost of nearly $1,000,000. Once used begrudgingly, the room is now full nearly 60 hours a week. But most classrooms can be renovated handsomely for one-tenth that sum.

Next, if the president and trustees agree that the teaching spaces should be made into contemporary and attractive rooms for the crucial work of teaching, you need to begin the renovations. The sequence of the renovations is important. In general, the rooms with the poorest ratings should be modernized first; and renovations should be distributed with one eye on the various constituencies so that no one sector of the university feels neglected. Depending on the money and the space available for moving classes, you will need to schedule about two to five renova-



MIT's Boynton Hall after it was renovated, 1989.

tions a year over 5–10 years. At MIT last year we had an ambitious, six-classroom, $1.9 million renovation program in place.

Are more professors demanding large-screen displays for computer and laserdisc projections?

The last of the seven steps, once the renovation schedule is underway, is to monitor the direction of your college and seek to predict the coming alterations in classroom space that may be required.

Are the institution's enrollments increasing or decreasing? Which departments are losing students and which are gaining majors? Is the financial situation mandating fewer classes under ten students? Is the university inviting more outside speakers and holding more conferences, which necessitate elegant lecture halls? Is there a new program of freshmen seminars being planned so that more college seminar rooms will be needed? Are more professors demanding large screen displays for computer, VCR, and laserdisc projections? You will need to stay on top of these changes and forecast the different classroom implications of these shifts. Close relations with department chairpersons and the best teaching faculty are a great help in this monitoring.

If teaching in the classrooms is the heart of higher education's enterprise, then investment in these classrooms to make them attractive, modern, and highly conducive to learning should be central to any college or university's physical planning. ■

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Effective classroom design depends on attention to detail as well as a clear understanding of overall objectives.

Design Criteria for Effective Classrooms

Wendell Brase

Editor's Note: This article has been edited by the author especially for this volume.

The University of California, Santa Cruz is in the midst of a $1.5 million program to improve its classrooms. Many of the flaws being remedied are *design* flaws, although the campus is fewer than twenty-five years old. This is a troubling realization. Why does a new campus suffer from problems of classroom quality? (Why, especially, a campus that takes special pride in its teaching?) Were budgets inadequate or the designers incompetent? In trying to answer these questions, we have looked back in some depth. There were perhaps a few architectural mistakes, but certainly not "incompetence." And budgets were tight, but not "inadequate."

The answer we sought was revealed by the widespread nature of the problem. We had built disappointing classrooms in projects spanning many distinguished architects and a variety of financial circumstances. The problem had to do with attitudes and programming: the attitude that the classroom element was the least demanding in the architectural program for an instruction and research facility. Client and architect apparently regarded classrooms as noncritical, unchallenging parts of the program.

What we *should* have done, looking back, was:

1. told our executive architects that effective classroom design is critically important;
2. stated design objectives that were unambiguous and understandable to everyone involved in the design process;
3. specified criteria in enough detail to hold the designers accountable for the results;
4. required follow-up by designers to ensure that design criteria were met.

Clear functional objectives and attention to detail in their execution are equally necessary in order to create effective classrooms.

Hearing and Seeing

Most classroom design failures derive from inattention to two basic user needs: the ability to hear and the ability to see. This assertion

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may seem naive in its simplicity, but it is nonetheless supported by ample experience. Almost every classroom design flaw we have remedied in the past several years can be traced back to users' needs to see or to hear.

A useful concept to understand in designing for good hearing and good seeing conditions is that of signal-to-noise ratio:

$$\text{Signal-to-noise ratio} = \frac{\text{signal strength}}{\text{noise (interference) strength}}$$

In general, as the ratio of signal-to-noise increases, the ability to hear (or to see) improves for the listener (observer). This basic concept will become clearer in the following discussion.

Hearing Conditions

What constitutes "signal" and what constitutes "noise" for a student who is attempting to hear a lecture? A strong signal results from an unobstructed line-of-sight from speaker to listener, which is facilitated by a raised platform for the lecturer at the "sending end" of a large classroom and by banked or riser seating, especially beyond the third row. Signal strength is enhanced by early sound reflections — those arriving within 30 milliseconds of the initial, direct sound. Thirty milliseconds corresponds to 34 feet of sound travel; thus, a reflection which arrives via a path 34 feet longer than the direct path will arrive 30 milliseconds later than the initial sound's arrival.

For the classroom listener, most noise takes the form of high background noise (or "ambient" noise). The most common sources of ambient noise are:

- noisy HVAC systems
- lighting ballasts
- projector fans
- external noise via open windows or through walls.

In addition, reflections arriving at a listener's ears *later* than 50 milliseconds after the initial, direct sound are heard as noise, and thus are problematic reflections as far as speech intelligibility is concerned. The worst forms of unwanted reflections are rear-wall echoes, which not only arrive late but also come from a confusing direction. A related problem is the "boominess" that persists in certain rooms, constituting noise as far as the signal/noise ratio is concerned.

In order to design for a high signal-to-noise ratio, the direct signal path must be line-of-sight, and certain room surfaces must be hard and properly angled to provide early reflections, as previously defined. Other room finishes must be "soft" (acoustically absorbent) in order to prevent boominess or a lengthy decay period for late reflections ("reverberation") or delayed rear wall reflections (echoes) — all forms of "noise" in the signal/noise ratio. Equally important, ambient (background) noise sources must be reduced to very low levels.

If the concept of signal-to-noise ratio is understood, its practical application is likely to be successful and not especially difficult. Specifics will be discussed later.

Seeing Conditions

For the ability to see in a classroom, the concept of signal-to-noise ratio is again germane. Signal is enhanced by a clear line-of-sight, by good illumination, and by contrast. A direct line-of-sight is, in turn, fostered by a raised lecturer's platform and banked seating in a large classroom — the same features that benefit good sound projection, already mentioned. Contrast is a function of the viewing surface used in a classroom and of its illumination and cleanliness, or of the resolution of optically projected images.

Noise, as it pertains to classroom seeing conditions, may take the form of a dirty blackboard, reflective glare of blackboard illumination, light spillage onto a projection screen, a low-resolution projector, or an excessively acute viewing angle for off-axis seats.

Specific Requirements

Following is a discussion of the required surfaces and finishes in a classroom, organized by location in the room:

- sending end (front wall and adjacent side walls and ceiling)
- side walls and rear wall (wall opposite sending end)
- ceiling
- floor/seating

Sending End

In a classroom of seventy-five or fewer stations, the front wall — the wall at the blackboard/sending end of the classroom – may be hard surfaced (sheetrock, blackboards) with no special acoustical shaping required.

For classrooms larger than seventy-five seats, the following design features should be employed, as feasible (the larger the classroom, the more of these features are necessary):

- The front wall, including blackboards, should be divided into two or three sections with outer segments angled inward to help reflect sound to the rear of the classroom and to reduce the acuteness of viewing angle for viewers on the opposite end of the front row of seats. (Generally, the flanking blackboards are toed-in to form a normal ray to the most distant, opposite-rear corner seating.)
- For fixed-seat classrooms, ceiling surfaces should additionally be shaped/angled precisely so as to project sound to the *rear* of the classroom; closer listeners will generally receive sufficient direct sound. In plan-view, wall surfaces at the "sending end" should be angled to reflect a lecturer's voice to the most distant, opposite-corner, rear seating. These angles must be determined using to-scale, longitudinal cross-section and floor-plan drawings, creating ray diagrams using ordinary geometric techniques. This is both necessary and easy to do. Utilize several, typical lecturer source-positions, including directly in front of the blackboard.
- Angle wall and ceiling surfaces to project sound to rear of classroom; sawtooth design may be used to achieve required reflection angle rather than flat, planar surfaces.
  (1) wall above blackboard angled downward sufficient to reflect lecturer's voice to rear seats

FIGURE 1

Applied Sciences Classroom, UC Santa Cruz. Note "sending end" shaping created by splayed blackboards and angled walls adjacent to blackboards.

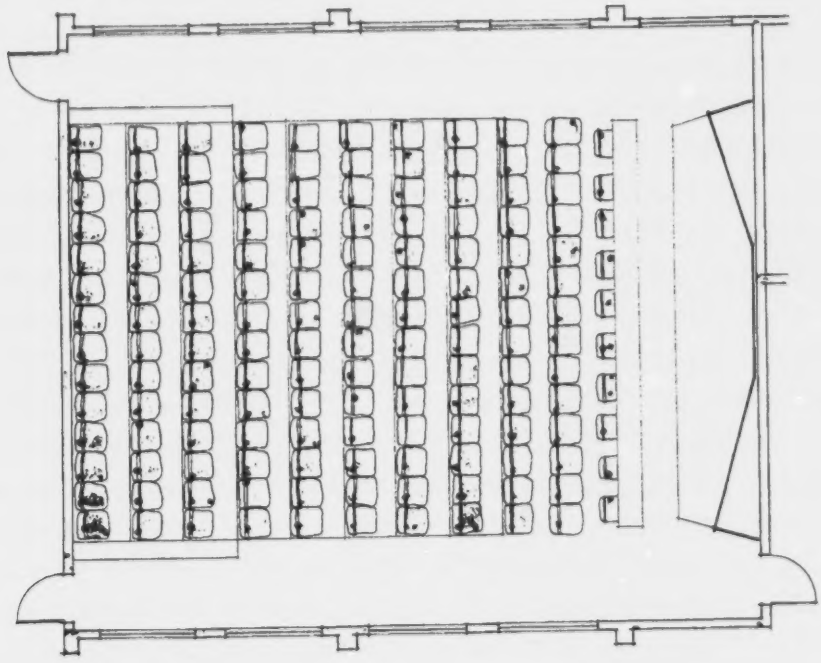
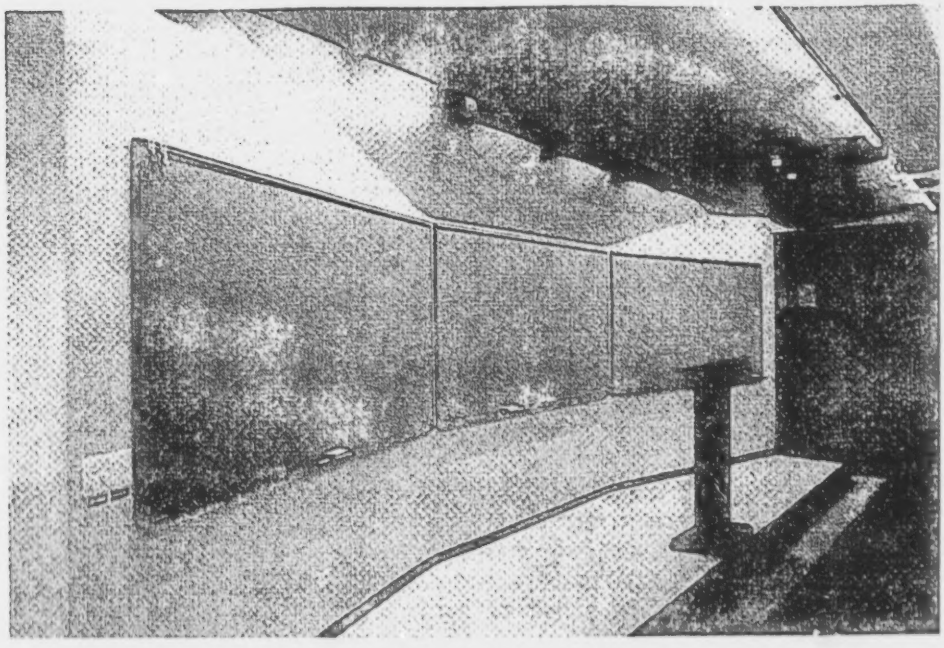


FIGURE 2

Stevenson College, UC Santa Cruz (150 seats). Note toe-in of outer blackboards, tilted wall surface above middle blackboard, and sloped ceiling surface above "stage" platform.



(2) sidewalls immediately adjacent to blackboard angled

(3) sloped ceiling in front half of classroom

It is important that the blackboard, side-wall, front-ceiling, and above-blackboard wall surfaces be angled with respect to rear seats using ray drawings, not intuition. Require the designer to prove that these angles are correct. Do not assume that this has been done when you see some evidence of shaping on the drawings.

Side and Rear Walls

Generally, a classroom's "rear" wall (opposite the "sending end" wall where blackboards and projection screen are installed) should be finished with a sound-absorptive material. In classrooms of greater than seventy-five stations, side walls should additionally be designed so as to project desired sound (early reflections) and to absorb undesired sound (late reflections), as follows:

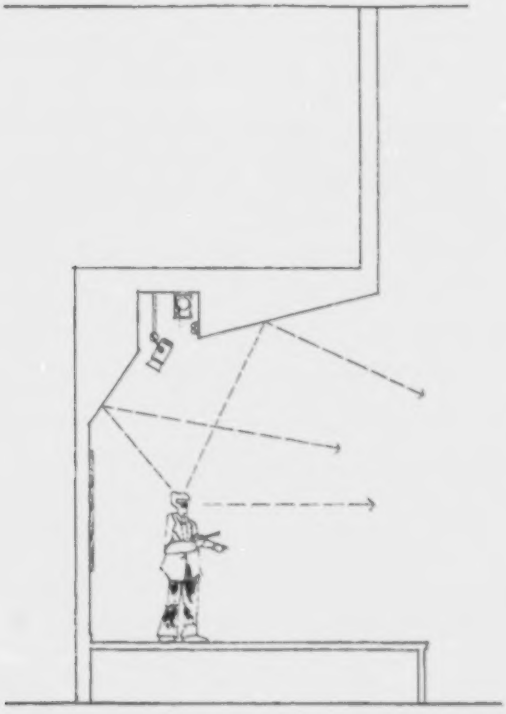
- Angle side walls at "sending end" of classroom (Figures 1 and 2).
- Select finishes for their acoustical behavior:
  (1) Front three-quarters of each side wall:
    a. Acoustically nonabsorbent—sheetrock, plaster, masonry, wood paneling, etc.
    b. Painted, vinyl surfaced, or other hard finish—not an acoustically absorbent finish
  (2) Rear one-quarter of each side wall and entire rear wall:
    a. Acoustically absorbent (absorbs useless reflections, dampens standing waves, and reduces boominess)
    b. Insist on durable materials for acoustically-absorbent finishes installed less than six feet above floor-level
    c. Projection booth glazing angle selected to avoid echo reflection back to stage.

Ceiling

- Ceiling height should provide early reflections to mid- and rear-audience — not too low and not too high.

FIGURE 3

Kresge College Town Hall, UC Santa Cruz. Note angles of above-stage ceiling surfaces and blackboard lighting behind the plane of projection screen.



- Ceiling should be hard, acoustically nonabsorbent such as painted sheetrock. (For rooms with fewer than fifty stations ceilings may be acoustically absorbent.)
- Ceiling should have minimum openings and penetrations, especially if noisy conditions exist above.
- For fixed-seat classrooms/lecture halls, shape ceiling using precise angles to assist in projecting early sound reflections to rear seats. See Figure 4.
- Rear one-fourth of the ceiling should be acoustically absorbent, similar to side walls (and for similar reasons).
- Lighting fixtures should be designed for minimum trapping of sound. For example, face panels on fluorescent fixtures should be acoustically reflective rather than open diffusers.

Floor/Seating

For flat-floor classrooms of fewer than seventy-five stations the following requirements apply:

- Floor carpeting is required unless 1. the rear wall is surfaced with acoustically absorbent material, 2. upholstered seating is installed, or 3. the ceiling is acoustically absorptive. A minimum threshold of acoustical absorption is required in any classroom for good speech intelligibility. Best hearing conditions generally require that the ceiling be hard; thus, the most cost-effective location for the required acoustical absorption is on the floor, i.e., carpet.

For classrooms in excess of seventy-five stations the following requirements particularly apply:

- A lecturer's platform of 7 to 22 inches (toward the higher end of this range as classroom size increases) is desirable, for both seeing and hearing conditions. (However, check first-row sightlines to blackboard if a demonstration bench is installed.)
- Fixed seating is desirable, for it enables the use of risers (as well as more seating per assignable square foot).
- Install fixed seating in radial plan based on origin approximately 30 feet behind center blackboard.
- In a flat-floor classroom, the projection screen's lower stop limit should be positioned high (>60 inches).

FIGURE 4

Humanities Lecture Hall, UC Irvine. This ceiling reflection study shows how reflected sound is intentionally biased toward rear seating.

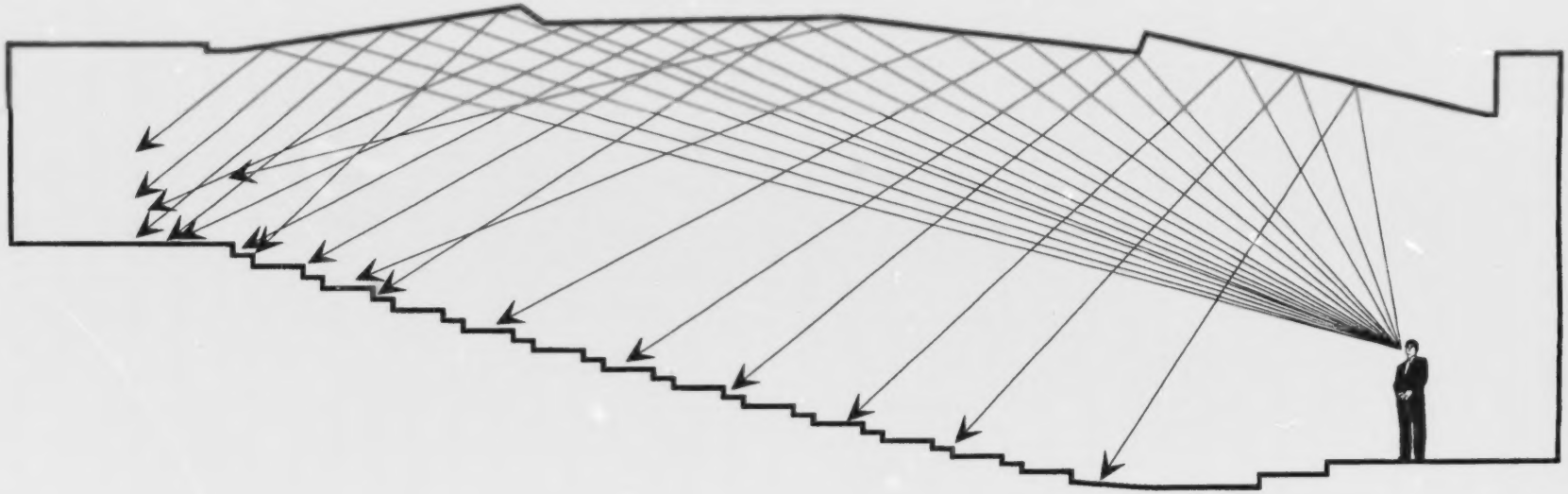


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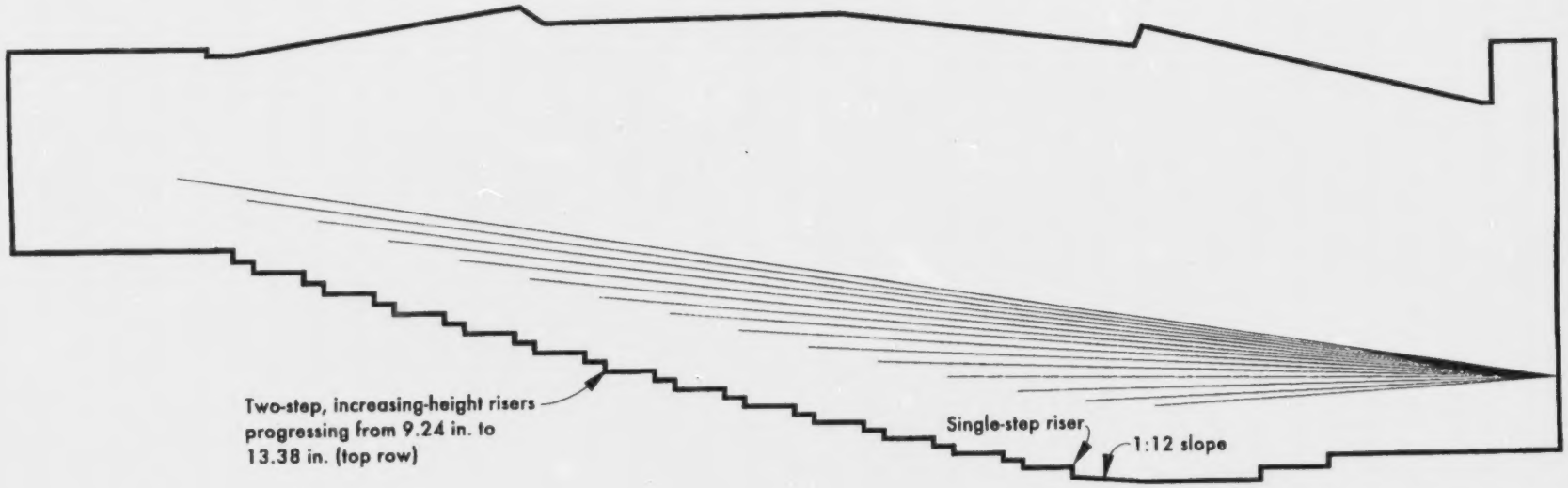
FIGURE 5

Humanities Lecture Hall, UC Irvine. Note sloping slab for first two rows followed by progression of increasing riser height. (Every situation requires specific analysis based on safe design practices and pertinent code requirements, in addition to desired sightline clearance objectives.)



- In classrooms larger than 125 stations, contouring of the floor is preferable to linear floor slopes or equal-height risers. Adherence to iscidomal floor contouring (see *Architectural Graphic Standards)* is required for good sightlines. Iscidomal conditions can be approximated where codes permit the following seating geometry: raised "stage" platform, 1:12 sloped slab for first 2-3 rows of seating, then single-step riser(s) transitioning to double-step risers, utilizing progressively increased riser height (with min/max riser heights and height increment as permitted by code and safe practice). See Figure 5.
- Note that steeply banked risers may not provide good sightlines from rear seating. Iscidomal sightlines require a gradual elevation change for rows near the "stage" and progressively higher risers from front to rear seating.
- In specifying a sightline clearance objective, consider the height-diversity of your student population. (UC Irvine now requires a sightline-to-sightline clearance of 7.5 inches, utilizing a visual objective six inches above the blackboard's lower edge.)
- Fixed seating should be upholstered because of the requirement for acoustical absorption.
- If seating is not fixed the floor must be carpeted, as acoustical absorption is required for speech intelligibility.
- Side aisles, radial aisles, and cross-aisles require carpeting (for standing-wave damping as well as reverberation control).
- A useful design concept is to make the first row of seating a continuous, fixed-in-place table (see Figure 1), with the following advantages:
  (1) it can provide nonhandicapped seating when used with movable chairs;
  (2) it can provide handicapped seating when used with a wheelchair, by removing a chair and setting it aside;
  (3) it can support an overhead projector or an occasional display or demonstration;
  (4) it can make many handicapped stations available when needed, while minimizing the loss of seating at other times.
- Classroom windows should be on the left side of the seated students. North light is preferred.
- Blackboard lighting angle needs careful selection in order to avoid reflective glare to front audience seating. Installing blackboard lighting behind the plane of the projection screen enables simultaneous use.
- For minimum spillage to screen, specify parabolic reflectors or a luminaire design which deeply recesses the light source and uses an efficient focusing reflector.
- Low-level illumination for note taking while slides or video images are being projected should be minimized in order to avoid degradation of the projected image. As little as one footcandle has proven sufficient for a student-age population, and the improvement in projected images is significantly improved at 1 FC vs. 5 FC, which is a typically cited standard.

Reducing Ambient Noise

The purpose of reducing a classroom's ambient noise level is to improve the ability to hear in the space by improving the ***denominator*** in the signal/noise ratio. The importance of low ambient noise cannot be overstated, for a noisy background level will ***negate*** all of the other measures that have been discussed. The following steps are required:

- If operable windows are necessary, the design should consider external exposure to traffic, cooling towers, exhaust fans, etc.
- Special attention will be required to identify and to isolate projector noise.
- Lighting ballasts, if used, should be "noiseless" high frequency/solid state.
- Seats having a quiet pivot mechanism and a rattle-free tablet arm mechanism should be specified. (Test a sample.)
- If noisy over-ceiling conditions exist (e.g., building mechanical system noise, high-velocity HVAC ducts, fume hood exhaust ducts, etc.), seal ceiling airtight and install surface-mounted fixtures.
- Ventilation should be carefully designed to attain the following peak noise criteria:

Fewer than 75 stations	NC-30
75 to 150 stations	NC-25
Over 150 stations	NC-20

- Install carpet in spaces above lecture halls and classrooms — especially corridors — where overhead footfall could be a problem.
- Ensure that walls, floor, and ceiling provide sufficient sound-isolation from adjacent spaces — especially mechanical spaces and (other) lecture halls where amplified sound may be used.

Quiet ventilation systems require 1. design attention from an experienced acoustical consultant, 2. careful specification and design from the HVAC designer, 3. competent installation and balancing, and 4. post-installation measurement/inspection. Generally, quiet HVAC design involves 1. distant fan sources, 2. low duct velocities (especially at and near the point of delivery), 3. acoustically-lined ducts, 4. suitable diffuser design, 5. lined duct segments downstream of turning vanes, junctions, dampers, or other noisy airstream devices, and 6. recognition that the "room correction" for diffuser noise specifications is typically *zero* for a large classroom or lecture hall (due to the number of diffusers).

Effective design of vestibules and corridors plays a key role in reducing the ambient noise in a classroom/lecture hall. Adjacent and contiguous corridors should be carpeted and their ceilings or walls should be finished with sound-absorptive materials to keep them quiet. Vestibules should be included in lecture halls where a combination of room size and/or noisy exterior conditions dictates the need. That is, lecture halls larger than about 200 seats will generally warrant entry vestibules, but smaller classrooms may also require vestibules if noisy conditions exist.

Lobbies and vestibules require:

- Sound-absorptive finishes on more than 60 percent of surface area
- Small vision panels in, or adjacent to, the hall's entry doors to enable latecomers to observe if a class is in session
- Panic hardware on the *outer* doors only (push-panels/no latching or panic hardware on the inner doors)
- Low illumination, to minimize light spillage when the doors are opened
- Preferably a large single door (e.g., 42-48 inches) rather than double-doors, which leak more sound.

Sound Reinforcement

A modern classroom sound reinforcement system is frequency-equalized, peak-limited, and overload-protected; moreover, it employs wireless microphones, sets it own level automatically, and cuts its own gain if acoustic feedback problems emerge. Such a system requires design by a qualified electroacoustician.

Audio components require secure rack mounting. Classroom audio components should be standardized to the extent practical in order to facilitate ease of maintenance and interchangeability.

If a lecture hall is designed to always be used with sound reinforcement the room shaping features described above are unnecessary, and the room can be designed "deader," with more sound-absorptive finishes. However, experience has shown that good hearing conditions (without sound reinforcement) can be attained in lecture halls up to three hundred seats through incorporation of the design features discussed above.

Designing for Durability and Functionality

The design guidelines outlined below provide for durability and functionality under institutional use conditions:

- A seat width of 21 inches is considered most suitable in terms of the comfort/capacity tradeoff.
- Install "left-handed" tablet arms for all seats on the left ends of rows.
- Light switches require proximity to lecturer position(s), straightforward layout, clear labeling, and illumination of key switches.
- Each lighting zone should be controlled by a separate switch:
  - blackboards
  - speaker's podium (focused illumination for simultaneous projector use)
  - demonstration area
  - general audience lighting (low level/normal level)
- Special care in fixture placement, luminaire design, and aim is required to keep light spillage off the projection screen.
- The projection screen should be motorized rather than manual even in small classrooms; the savings from avoidance of jammed and overextended mechanisms justify the expense.
- Equipment, including fixed seating, should be standardized to enable stocking of spares and efficient repair and replacement.

- Fixtures, cabinets, tables and countertops, and furniture should be surfaced with high-pressure plastic laminate.
- Seats require an integral-color plastic seatback which wraps the upper rear edge, where students' propped feet typically cause accelerated wear, especially in an institutional setting.

Conclusion

This discussion pertains to most general use classrooms and lecture halls. Additional technical analysis would be required for specialized spaces such as art history classrooms, science demonstration classrooms, teaching laboratories, music classrooms, computer labs, and projection booths.

Effective classroom design depends on attention to detail as well as a clear understanding of overall objectives. Do not be misled by the fact that many of these details sound common sense. A design checklist in the architectural program for any new classroom should include these details. An understanding of the design factors that affect auditory and visual performance can result in effective classrooms. ■

Today's laboratories require facilities planners who understand the new environment for scientific work.

What Kind of Workstations for the Laboratories?

Nolan Watson

During the past two decades many of the 2100 U.S. four-year colleges and universities and a good number of the 1400 two-year institutions have either built new science facilities or renovated their old laboratories. And others are planning to do so when funds become available. The techniques and equipment of scientific and engineering investigation, instruction, and invention have become more sophisticated; and science and technology have become more important in contemporary scholarship and research.

A vital part in the design of new laboratories on campus is the workbenches, or what architects call the laboratory casework systems. These worktops, cabinets, pipes, and storage areas are to science students and faculty researchers what good desks and file cabinets are to college administrators or writers. They are the indispensable counters at which students learn their science and where researchers discover new facts about geology or chemistry, biology or mechanical engineering.

But different sciences require different counter tops. For example, geology laboratories do well with hardwood counters while chemistry laboratories with acids cannot endure wood or metal counters and usually require chemically-resistant laminate or epoxy resin counters. Also, research or specialized laboratories need a far more flexible casework system than instructional labs in the basic sciences. Storage capacity is more important for some sciences than others; and labs that operate vibration sensitive equipment such as high-power microscopes and balances require special balance tables that reduce building vibrations or a casework suspension system that minimizes the tremors.

So choosing the right casework system for a laboratory is a major decision for facilities planners and campus architects. Having worked as a research scientist, science facilities manager, and laboratory planner, I want to offer some general advice and de-

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scribe the four kinds of "industry standard" casework systems which campus facilities leaders should evaluate during the design phase of a laboratory modernization or the construction of new labs.

Generally speaking

Here are several considerations that I believe are crucial for deciding about the choice of laboratory furniture.

Cost. The first cost of laboratory casework represents only 10 to 15 percent of the construction budget. But the contribution to the laboratory's success is far greater. So colleges should not skimp on the lab's working tables and equipment. If you cut costs here, you'll pay later. Do all you can to avoid low-bid equipment. Write the specifications tightly to make sure you get good casework. Pomona College in California has laboratory tables that were built in the 1930s. They were built so outstandingly well that they are still good worktops in 1995, making Pomona's casework very cost-effective because other colleges have had to replace their casework every 20 years or so.

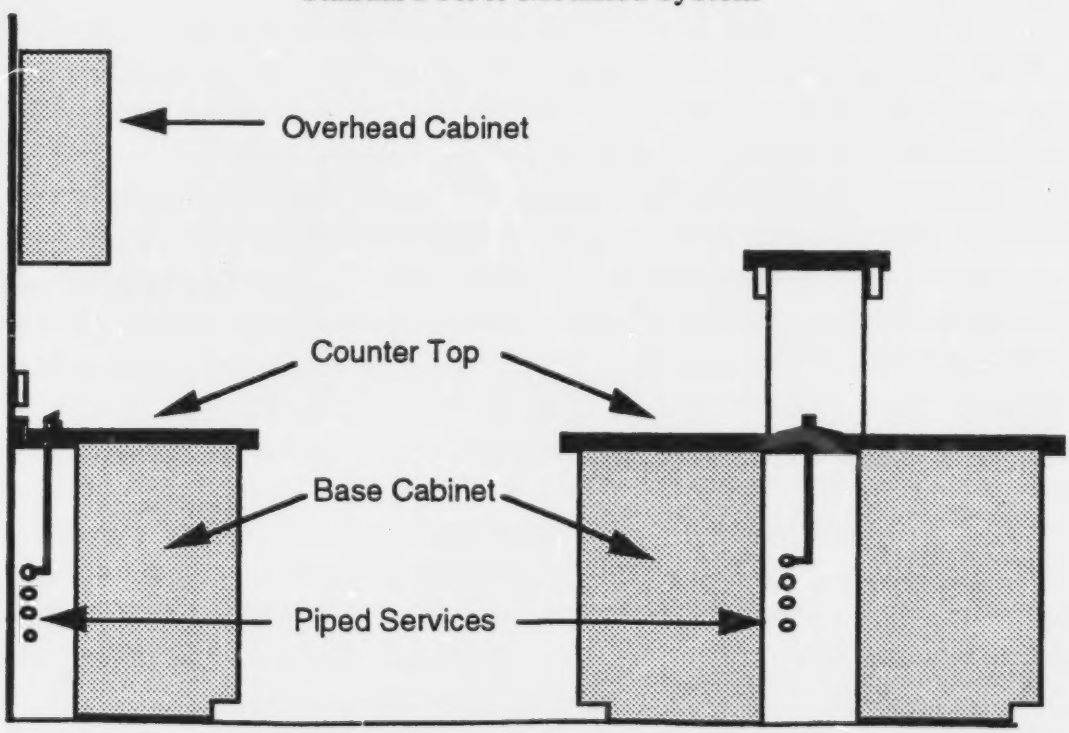
Flexibility. Basic science classes can install a fixed casework system because the work is relatively unvarying. But research laboratories demand highly flexible lab furniture that can be rearranged for novel experiments or for the use of extraordinary equipment. Flexible casework is more expensive but necessary for research at medical schools, graduate school science labs or advanced engineering centers. Sinks, including cup sinks, however, are fixed elements regardless of the casework system.

Colleges should not skimp on the lab's working tables.

Utility serviceability. I recommend strongly that nearly all the utility distribution be visible and accessible. Plumbing and other utility fixtures should be outside, not inside, the partitions. This facilitates servicing, repairs, and changes to accom-

FIGURE 1

Standard Floor-Mounted System



modate new utility requirements. Aesthetically, this arrangement also lends a workshop appearance to the lab, enhancing the sense that science and technology require hard work and precision.

Storage capacity. Be sure to consult the science or engineering professors and lab assistants about the storage needs. Different sciences have different storage requirements; and basic science classes will need very different storage capacities from, say, nuclear engineering labs or live animal research labs.

Availability of compatible components in the future. One of the frustrations for laboratory scientists is to find out that the company that built their casework has gone out of business, or that replacement parts are no longer available. So it is wise to avoid shaky manufacturers and exotic fixtures.

Special considerations. Keep in mind that ADA Title III compliance requires that a small number of laboratory benches and workstations be accessible to the disabled. Controlled-environment "cold rooms" with high relative humidity should have corrosion-resistant shelving and casework. High-tech "clean rooms" that permit no particulate matter require special casework to minimize off-gassing (the emission of vapors from building materials and carpets) and to withstand rigorous cleaning procedures. Your university may have other special laboratory needs.

Be certain to consult extensively with the scientists, researchers, graduate students, and laboratory technicians before you renovate or construct new laboratories to learn how the labs really work and what the necessities are for productive teaching and experimentation.

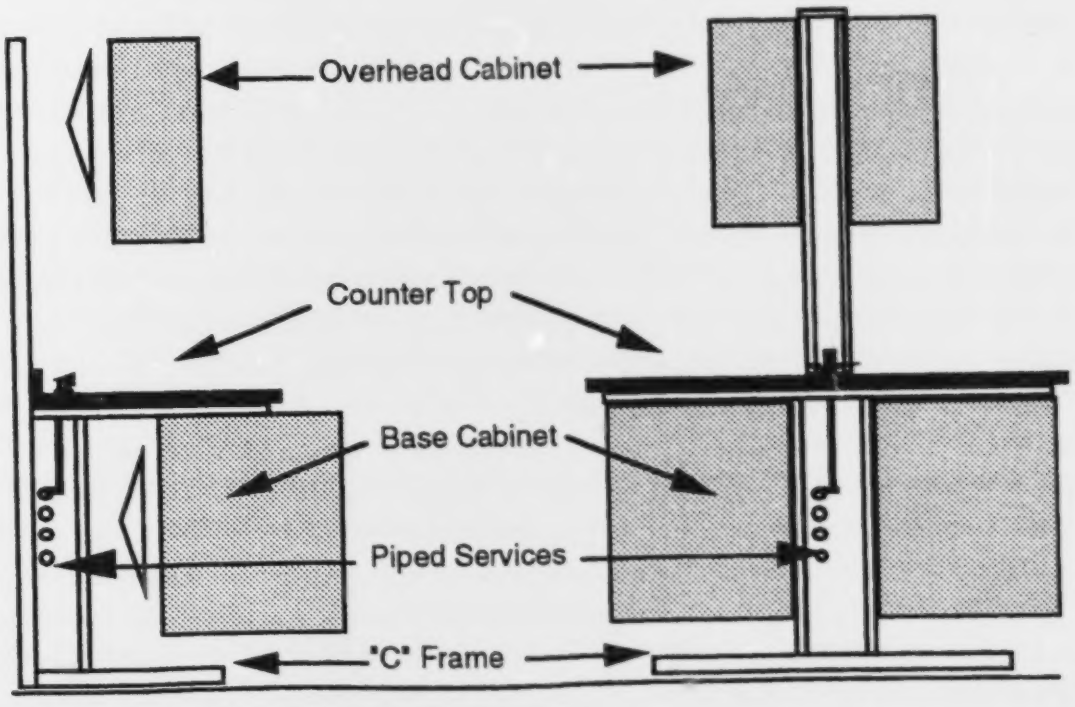
Four ways to go

There are four classes of casework systems, each with its own advantages and disadvantages. Facilities planners and architects should know of these four, and understand which is best for each laboratory.

1. The Standard Floor-Mounted System. This is the system of laboratory worktops, cabinets, and piping found in basic science labs in colleges, universities, and secondary

FIGURE 2

C-Frame System



schools. (See Figure 1.) It comes in a premanufactured modular design or can be built in place. The counter top is continuous and mounted on top of the base cabinets. The overhead cabinets are typically placed only against a solid wall, and backing is required in the walls for the installation of overhead cabinets or open shelving.

Your institution can become dependent for the availability of components in the future.

The support and suspension system is basically the floor and fixed partitions. As a result, all elements are fixed. The counter tops over the floor-mounted cabinets have no major load limitations. However, they have fixed heights and are not easily changed to accommodate changing lab needs. The cabinets are available in wood, steel, or plastic laminate finishes. An example of this kind of casework is the Standard Lab Furniture System made by Hamilton, Kewaunee, and other manufacturers.

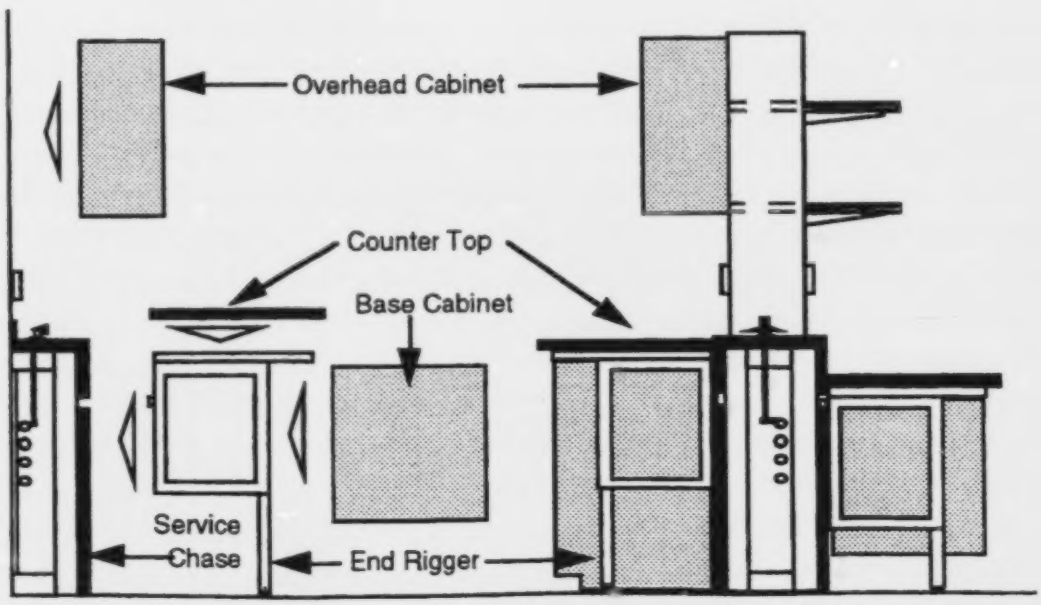
The advantage of this system is its comparatively low cost and fairly easy installation. It is ideal for introductory science classes and small colleges. The system is inflexible though, and requires skilled tradespeople to relocate the base cabinets and knee spaces if the work flow changes.

2. The C-Frame System. This casework system has a C-shaped tubular steel frame, with the counter tops and cabinets mounted from this steel frame. (See Figure 2.) One leg of the C rests on the floor while the other supports the lower cabinets and counter top. The counter tops may be specified in modular lengths between the leg frames, allowing for the removal of entire units to make room for floor-standing equipment. The vertical leg extends above the counter and supports the upper cabinets or open shelving.

The C-Frame System has horizontal flexibility since the lower cabinets can be removed and replaced, thus creating knee space in different locations. This feature also makes the utilities more accessible for repairs or changes. There is also easy clean

FIGURE 3

End Rigger System



up beneath the lower cabinets. But usually there is 25 percent less storage space than in the Floor-Mounted System.

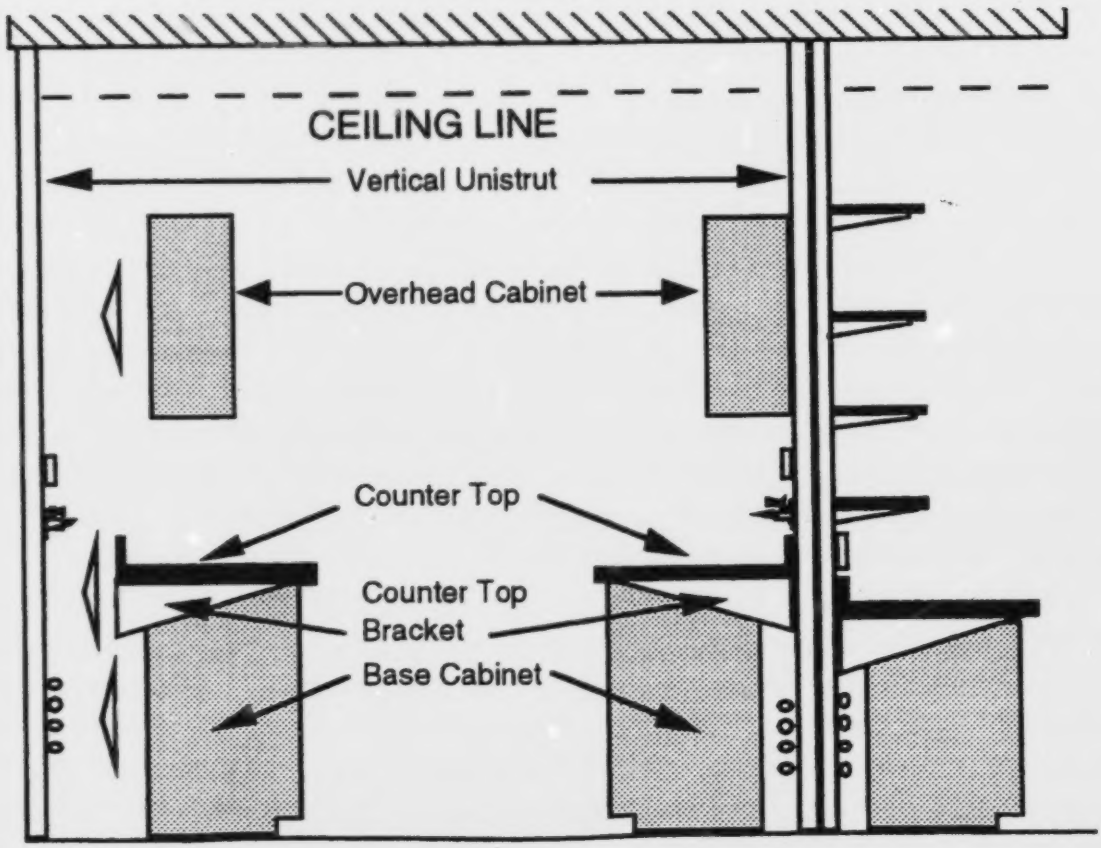
The cabinets can be constructed of wood, steel, or plastic laminate. And this system can be fabricated locally or specified from some proprietary source like Hamilton. The system is moderate in cost, but your institution can become dependent on local artisans or the manufacturer for the availability of components in the future.

3. The End Rigger-Leg Frame Suspended System. This type of system has a few different designs, but all have an enclosed tubular steel service chase behind the lower casework, which is stabilized laterally either by end-rigger panels at the ends of the casework or by legs, as illustrated in Figure 3. A tubular steel frame is supported off the service chase. In one design the counter top rests on top of a steel frame and the lower cabinets are suspended from below the frame by clips. In another design the counter rests on leg frames, again as illustrated in Figure 3; and the base cabinets may be supported on the floor or suspended by clips from the top.

The overhead cabinets or shelves are supported by vertical framing members in the service chase. The major advantage of this system is its flexibility. The lower cabinets can be easily removed and replaced, and the counter top framing can be raised or lowered. Nearly every element can be changed as needs dictate. The counter tops come in sections, creating joints at the spine and at adjacent tops. The cost, however, of this system is higher than the Floor-Mounted System, but generally less than that of the C-Frame System. Again, cabinets are available in wood, steel, or plastic laminate finishes.

FIGURE 4

Unistrut System



This system must be specified from a proprietary source. This makes the availability of components dependent on the stability of the original manufacturer. Examples of this system are the Hamilton Multiflex and the Kewaunee Versalab.

4. The Unistrut System. This system is not an integrated system like the first three because it is usually customized from various suppliers. The system's heart or backbone is an industrial open channel that extends from the floor to the ceiling. The wall elements are hung from brackets on this vertical channel. The base cabinets are usually specified with adjustable nylon and/or stainless glides, and they are free standing.

As illustrated in Figure 4, the counter tops and back splash are supported by large brackets attached to the vertical channel, and they are easily adjustable. Additional loads may be placed on the counters that are over the base cabinets by adjusting the glides of the base cabinets to pick up some of the load and transmit it to the floor.

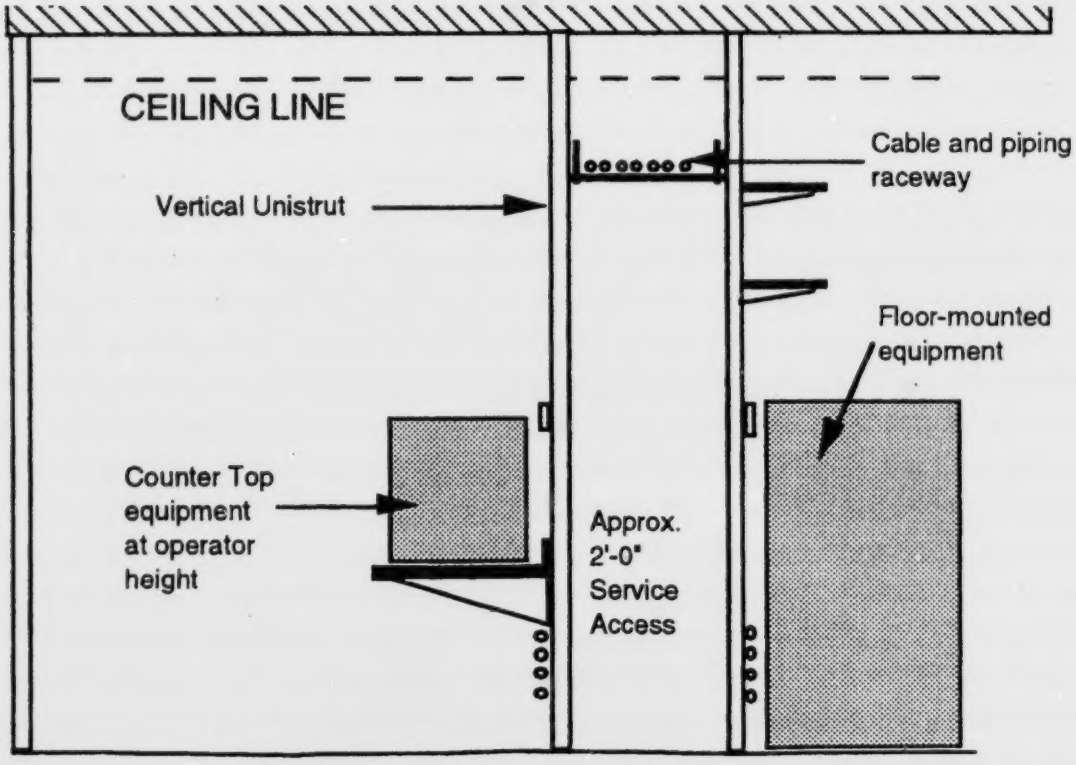
Laboratory furniture should be for the next decades.

This is the most flexible and adjustable of the four systems. The only fixed elements are the vertical channels. But the Unistrut System requires great attention to detail during design and because of customization can be quite expensive. The channels and brackets are available from Unistrut and other suppliers. The other components such as shelves, cabinets, and counter tops can be purchased from casework suppliers or built by local cabinetmakers.

The Unistrut System is especially appropriate for labs with major analytical

FIGURE 5

Overhead Raceway for Utilities



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equipment—mass spectrometers and the like—where counter tops may need to be removed or set at specific heights, and special wiring and piping may be needed behind the advanced equipment. As Figure 5 shows, a two-foot space can be created for easy servicing and an overhead raceway for the utilities.

Which to choose?

Facilities planners should consider the pattern of laboratory use, and the work flow of the professors, research assistants, and students. Clearly, no one casework system will satisfy the requirements of all the labs. And the costs of the systems and their flexibility must be weighed. Each system has advantages and disadvantages, which I've tried to present schematically in Figure 6. (The ratings are only a rough guide, using the Floor-Mounted System as the norm.)

One last piece of advice: try to get faculty and other users of the laboratories to think of the next generation of lab users, and to visit the most advanced laboratories at peer institutions. Laboratory furniture should be for the next decades and the new direction of scientific work, not just for today. ■

FIGURE 6
Advantages of each of the four systems

	first cost	degree of flexibility / adaptability	degree of utility flexibility / servicability	storage capacity	future availability of compatible components
Floor Mounted	1	1	1	1	1
C-Frame	1++	1+	1+	1-	1
End Rigger	1++	1++	1+	1	1
Unistrut	1+	1++	1++	1	1++

How can colleges house the explosion of books and journals? Can technology really help?

What Size Libraries for 2010?

Michael Matier and C. Clinton Sidle

Given the explosion of knowledge, every college and university library needs to grow constantly. The growth in printed materials is escalating at ever-increasing rates. For example, between 1960 and 1987 the number of volumes published in the United States alone increased 373 percent, from 15,012 to 56,027; the world book title output increased 213 percent over the same period (*Bowker Annual* 1964 and 1992). The number of scholarly journals has grown even faster in the past 30 years.

Therefore, a major problem for facilities planners at every campus is how much library space to plan for in the future. What is a college or university to do when it is facing acute financial difficulties yet its library space needs are doubling roughly every 15 years? Must the foot-print (square footage) of the library necessarily grow into perpetuity?

At Cornell University we decided to create a strategic plan for library space needs through the year 2010 to obtain answers to some of these questions. With the thought that our process and thinking may be useful to planners at other campuses, we offer this article.

First, some sentences about Cornell. It is a 126-year-old private research university which also serves as the land-grant university for the State of New York, housing its agriculture, industrial and labor relations, home economics (human ecology now), and veterinary medicine schools—a unique arrangement. It is located in rural upstate Ithaca, although the medical school is in New York City. There are approximately 12,500 undergraduates and 5,500 graduate and professional students. For these students, there are 16 separate libraries on the Ithaca campus. The total library collection is 6.4 million volumes, and has been growing at a net rate of 2.2 percent a year.

The NASF, or Net Assignable Square Feet, of the Cornell Library has expanded enormously since 1951 (see Figure 1). Still,

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C. Clinton Sidle is director of Cornell's Office of Institutional Planning and Research. He received his B.A. and M.B.A. degrees from Cornell and has held several positions in financial accounting and planning at Cornell before assuming his present position in 1988.

9 of the 16 libraries on the campus have space deficits, and most lack adequate fire and security systems, limited access for the disabled, and deficient climatic controls. Also, electrical loads and outlets in several of the libraries have been stretched to the limits by new electronic equipment and pose a constraint to the installation of new library technologies. This has become a major problem since, as Patricia Battin has written (1990, p. 3):

> Approximately 90 percent of the information needs of the academic and research programs depends on an essentially 19th-century information system. It coexists with an emerging 21st-century information system that serves only 10 percent of the those needs. The coexistence contributes to a frenetic schizophrenia among students and faculty, who expect the efficiency and convenience of electronic facilities from traditional libraries services and the comprehensive literature coverage of traditional library collections from electronic systems.

Another issue at Cornell—one shared with many other colleges and universities—is the desire by trustees and campus leaders to limit new construction on the central campus to preserve attractive green space. And university leaders and trustees are becoming convinced that higher education is at the edge of the "virtual library, i.e., a library that provides access to electronic and print materials from many sources, both local and remote" (Dougherty and Hughes 1991, p. 4).

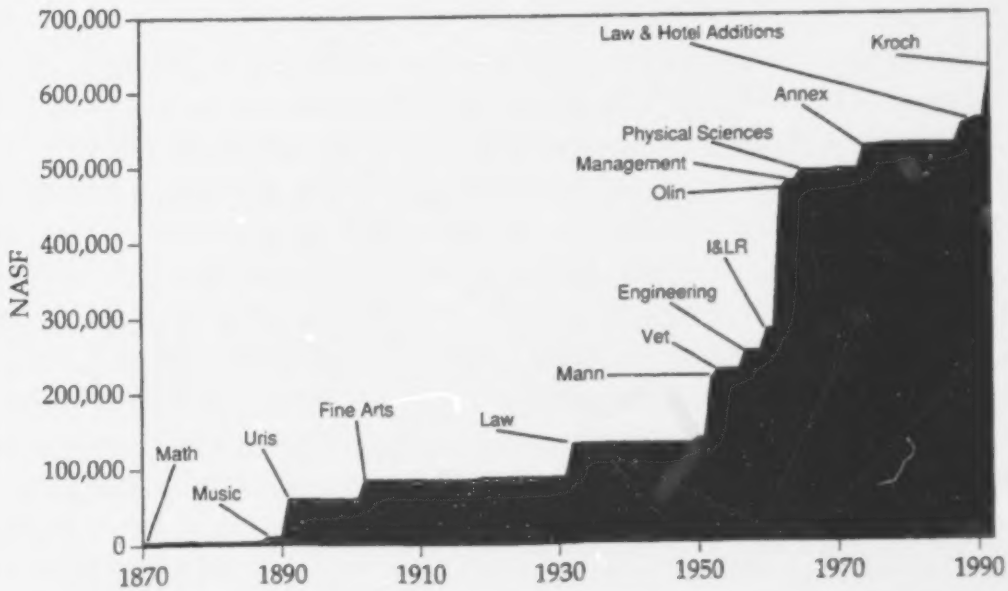
So, with pressures to provide more library space, more modern library facilities,

A major problem at every campus is how much library space to plan for.

and more technology and to limit new construction and burgeoning library costs, the provost in February 1990 initiated a process to examine Cornell's future library needs through 2010, with special attention to those 9 of the 16 campus libraries that had severe space problems. It was to be a collaborative effort of the librarians, information technology specialists, and the planners in our office.

FIGURE 1

The increase of library space at Cornell University, 1870-1992



The approach to library planning

We quickly decided that we would use two separate approaches to analyzing Cornell's library space needs. One was the conventional approach where collections and user space needs are projected into the future based on estimated growth rates and modified national library standards for space utilization. The conventional analysis was conducted for each of the Ithaca campus libraries and focused on these variables: primary user population, collection growth rates, user/reader space, use of the Library Annex and compact shelving.

The other approach was more strategic. We looked at the potential impact of digital space-saving technology on the conventional projections. In effect, we tried to estimate how new and forthcoming technology might alter the old-style calculations for future library space needs. With this second approach, which we describe in the next section, a surprisingly different plan for library space emerged.

For the conventional analysis we employed traditional library standards: State University of New York standards for the land-grant colleges and the generic national standards of Leighton and Weber (1986) for the endowed libraries. We frequently customized the Leighton and Weber standards to fit our local situation, especially when they seemed much too liberal for one of Cornell's libraries. For example, the industry standards for shelving density is 10 volumes per square foot but most Cornell libraries had densities of 12 to 20 volumes per square foot.

We based the growth of collections estimate on the rate of increase for the most recent five-year period, using an annual incremental volume increase, not a compounded growth rate. We believe acquisition budgets will grow in a more modest linear fashion in the future even though library material costs are expected to rise in a non-linear fashion. When you account for inflation, libraries have "lost ground steadily and consistently since 1972" (White 1991), particularly because of the rising costs of U.S. serial publications where the average price "has increased almost 400 percent since 1977, and 72 percent since 1986" (Tomer 1992). We thus believe the Library's average annual growth will drop from the present 2.2 percent to 1.6 percent by 2010, with the total collection growing from 6.7 million volume equivalents in 1992 to 10.5 million in 2010.

We assumed that the user population of undergraduates, graduate students, and faculty would remain constant. National standards call for reader spaces for 25 percent of the user population. But the proportion of reader spaces required varies considerably from library to library. For instance, law libraries require reader space for 75 percent of user population while engineering libraries can meet normal demands with 20 percent.

Standards call for reader spaces for 25 percent of the users.

Most of the Cornell libraries made space projections using both remote storage and more compact shelving to house collections. (Cornell has a Library Annex several miles from the central campus, adjacent to the university's apple orchards, for materials not frequently in circulation.) Compact shelving allows more books to stay on the central campus, though access to the books is more time consuming since the shelving is mechanized, and the floors holding this shelving must be capable of bearing twice the load of conventional shelving. The degree to which the constituent libraries anticipated using remote storage and compact shelving varied. Older materials are not as vital to research in most of the sciences, for instance, as they are in the arts, humanities, or social sciences. So the Physical Sciences and the Engineering libraries anticipate a heavier use of remote and compact storage.

Overall, our analysis found that about 12 to 18 percent of all library holdings will

be stored in remote facilities or compact shelving by 2010, which will require improved delivery services. Thus, Cornell's Library Annex, built to hold 500,000 volumes, will need to be augmented to hold at least 1 million volumes by 2010.

In summary, our conventional analysis found a need for 163,400 additional NASF right now, an additional 82,545 NASF in the year 2000, and yet another 88,366 NASF by 2010.

A strategy to reduce space needs?

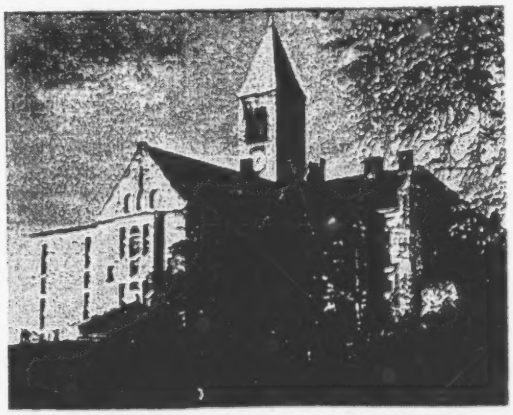
In our second, more strategic approach, we tried to figure how emerging technologies could reduce the conventional projection for more space and larger budgets. For the past 20 years, libraries have used new technology primarily for back-office functions such as acquisitions and cataloguing (Battin 1990). In the future, technology will have its greatest impact on user services, and on the way libraries conduct their business. Holdings themselves will undergo significant change as an increasing proportion of reading material becomes available in digitally encoded forms. In turn, this will change how materials are stored, and the way in which library services are delivered.

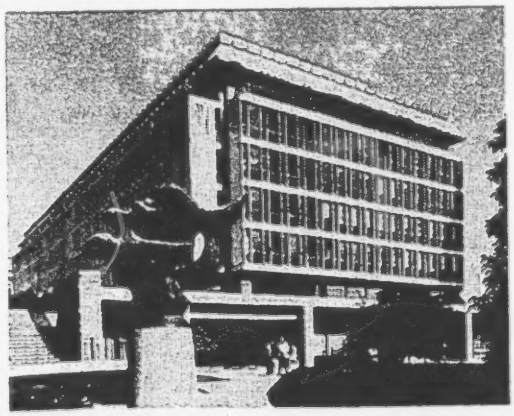
That much is clear. What is less clear is how soon the new technology will be available, and how much it will cost. At present, the most promising technologies are not mature and costs are uncertain. Therefore, our second approach focused on identifying the technologies that will make the most difference, when they might become available, and how much they might costs. How could we make the most sophisticated estimates?

We decided not to employ outside experts. Instead we held five months of meetings with librarians, planners, and Cornell's best information science and technology staff, working both as a committee of the whole and as subgroups. Gradually we identified the emerging technologies that might most directly impact our space needs, after doing empirical research on the relative strengths and weaknesses of embryonic technologies with special attention to their probable acceptability to Cornell's library users. We then modeled their possible effects on space needs and their cost effectiveness.

The most promising technologies are not mature.

Libraries already use several technologies: online catalog, microforms, facsimile transmission, interlibrary loan, and remote storage. Some are candidates for expansion. Some, such as microforms, have never lived up to expectations and have been a failure in user acceptability. Others, such as interlibrary loans, have nearly maximized their value but could be expanded with advances in networking and digital storage. Then there are several new





Uris Library (left) and Olin Library (right) are two of Cornell University's 16 libraries. How many more libraries should universities construct in future years?

technologies such as optical scanning (taking a "picture" of a page and storing the image in electronic format), full-text imaging (electronic storage of the individual characters that comprise a book page), and the mass storage of digitized information in either optical (CD ROM, for example) or magnetic media. In estimating the potential repercussions of these nascent technologies, several factors come into play.

Appraising the new technologies

For one, the pace of technological advances for materials produced in digital formats will be driven by commercial viability. Librarians with collections in law, medicine, engineering, science, and management, where the private consumers are in a better position to pay for this form of information, will experience the fruits of new technologies before the libraries with collections in the arts, social studies, and humanities. This does not mean that libraries should be passive and wait for technologies to be developed elsewhere. Cornell, in cooperation with Xerox Corporation and the Commission for Preservation and Access, is optically scanning and digitally storing a collection of old, fragile, out-of-copyright monographs to test the feasibility of digitizing endangered materials, storing the images on compact discs, and creating a cost-effective means of providing paper copies on demand to users (De Loughry 1992).

Another factor is copyright law. Concerns about copyright protection have already constrained publishers from moving swiftly into the digitization of materials. However, publishers can be expected to set higher prices on users' fees for electronic materials than on other media because of the greater potential for unauthorized duplication and distribution. With the assistance of Cornell's legal counsel, we concluded that the scope of copyright protection is the same for digital information as for information stored in other forms. Thus, if a library plans to reformat materials in digital form, it must either choose materials not protected by copyright or be prepared to enter into contractual arrangements with publishers similar to those made with site licenses in the software industry. As yet, there is no precedent in the industry for this activity.

Of all the issues surrounding the choice of digital versus paper storage of information, the effect on a library's services to users is the most speculative. Will readers and researchers use their workstations to browse and read texts or will they insist on paper copies?

Putting information into electronic forms will not necessarily increase accessibility. Current library practices depend very heavily on the self-help of readers in locating books, browsing, walking to remove them from the shelves, checking them out, etc. The electronic library could shift much of the responsibility—and costs—of informational retrieval to the library and the college or university. This could lead to the controversial option of charging patrons for the use of certain college library services.

Current library practices depend heavily on the self-help of readers.

Still another factor is cost. Converting to electronic materials is now more expensive than building paper document collections. But this will not always be the case. Our planning group believes the cost of the technology itself will not be the major obstacle. The issues are rather the costs of implementing the use of the new technologies in a way that satisfies busy students and faculty, and the multiplicity of costs associated with developing, acquiring, maintaining, and using digitized library materials.

In order to estimate when digital storage might become affordable, we developed a cost model, assuming the technology could be applied to any volume. The costs of this process were generalized for converting 100,000 volumes to digitized form compared to the costs of housing a like number of

books in a newly constructed remote storage facility. (See Figure 2.)

The model is crude and parameter sensitive, but it suggests that the cost of converting to digital storage could approach the cost of constructing new remote storage in 1996 or 1997. However, the model does not include the costs of converting volumes protected by copyright, which are 80 percent of the collection. If by the year 2000 every volume in digital storage were charged $20 a year in user fees, the two options would cost about the same.

Furthermore, materials selected for digitization should be those used infrequently. Anyone wanting to read more than a few paragraphs will most likely want a paper copy.

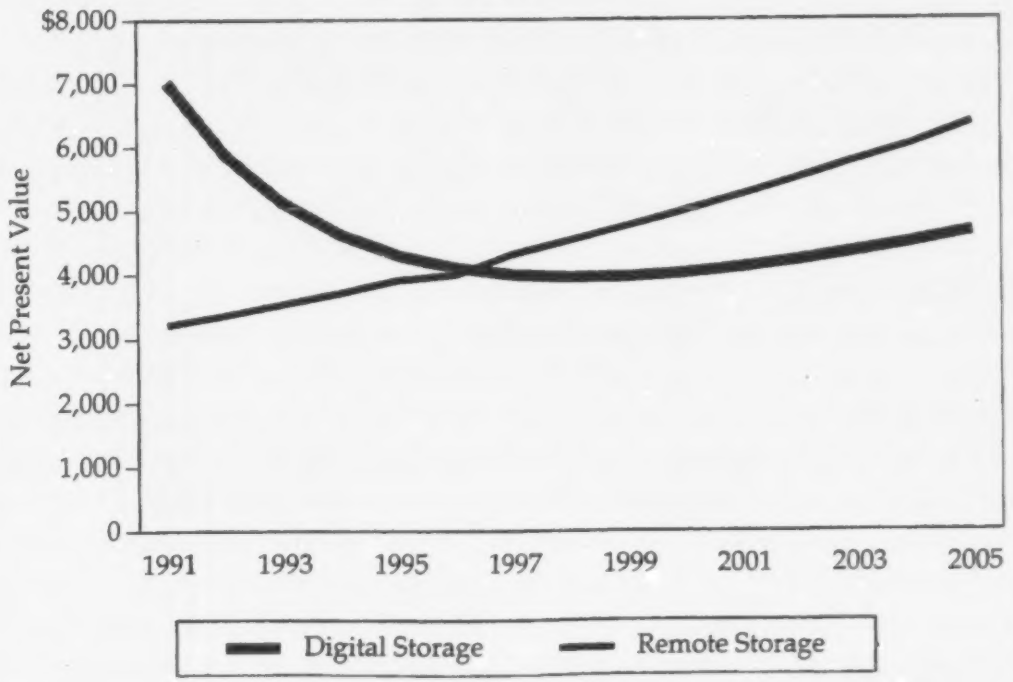
The establishment of a highly electronic library that is also user-friendly will be an enormous, complicated undertaking. It will challenge the very foundations of how university libraries are used and the very nature of intellectual property. Even if the research and development process leads to what appears to be a real alternative to the present library, there are no guarantees that the capital investment in technology will be all it was intended. The example of microfilm is not one to be taken lightly. It was expected to be a major space saver, but its unacceptability to most users has limited its efficaciousness.

We concluded that there is so much uncertainty regarding the development of technology that it would be imprudent to develop a planning strategy for the next two decades with technology as the linchpin. Rather, we decided it would be the best to pursue the technology option vigorously, but remain open about timing, user reception, and costs. As one observer noted (Tomer 1992):

> As many librarians have discovered in recent years, waxing lyrical about the virtues of the online public access catalog or the full-text database is one matter, but finding the money to finance the services, terminals, printers, and licenses to support this mode of delivery is another.

FIGURE 2

Estimated costs of digital and remote storage of 100,000 volumes
(Dollars in thousands)



The bottom line

For the year 2010, our planning group found that space for library collections must inevitably increase, as they must at all good colleges and universities. But we also found that the emerging technologies could begin to be sufficiently developed and cost-effective by the year 2000 so that space needs for the libraries, especially on the central campus, should slow appreciably after the turn of the century.

Every college should do strategic planning for its library space.

Thus, we recommended that additional space, as measured by conventional practices, be added through the year 2000, but that most collection growth after 2000 be managed through either technology or remote storage. To make more remote storage possible, we recommended that the university build an additional or new Library Annex, and that better user-friendly access and delivery services be developed so that students and faculty could use the off-campus volumes readily.

We also suggested that a few of the libraries consider consolidation, such as Mathematics and Engineering, even though some faculty object. And we noted that the university consider study lounges or renovated residence halls to reduce the demand for more reader spaces in the libraries. Many students use the library as a quiet study hall without using any library services. Providing alternative study spaces would permit the university to scale back its user space needs.

A final note. Given the rapid growth in the number of books and periodicals, in the number of films, recordings, audio tapes and video tapes, and in the requests for instruction, references, and assistance by library users, every college and university should engage in strategic planning for its library space over the next 20 years. Proper library space and resources are, needless to say almost, essential for serious intellectual inquiry. ■

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BOOK REVIEW

Designing Better Classrooms

Design of General-Purpose Classrooms and Lecture Halls, by Robert Allen. Pennsylvania State University, 1991. 53 pages.

Reviewed by Hunt McKinnon

This publication is more like a fat pamphlet than a book, but it makes up for its brevity with its completeness. It is an extraordinarily useful little manual on the interior design of small general purpose classrooms and large lecture rooms, and is well-organized and full of design ideas that will improve the teaching environment on campuses.

As the preface discloses, the idea for the booklet "grew out of a shared need for such a reference tool by a number of facilities and instructional people." Apparently a group of facilities planners conceived the idea for such a manual in 1988, and the collaborators—from Penn State, Georgia, Indiana University, Maryland, Ohio State, and West Virginia University—presented their views on classroom design at a conference at the University of Maryland in 1989, after author Robert Allen had visited nine universities to inspect classrooms. The committee and author Allen met twice more and kept a "steady flow of paper" going until the manual was done. This appears to be a committee that really worked. And it worked well because their product is near-encyclopedic despite its brevity.

While every college and university has classrooms, and classrooms are the heart of the learning process, the design and modernization of classrooms is astonishingly neglected on most campuses. As the book notes, "On a typical campus, classrooms belong to no one." That is, the responsibility for their appearance and equipment usually falls in between the duties of the vice presidents of academic affairs, administration and facilities, and students, and those of the deans. How strange! Classrooms are the most important rooms for teaching and learning, and yet the least cared for.

This little book aims to put the best ideas about how to design attractive, functional, and effective classrooms into the hands of every department head, dean, vice president, and facilities manager, as well as the hands of architects who are designing new classroom buildings. The book is organized by topics such as space relations, and entrances and exits, and is divided into two sections for small classrooms and large classrooms.

Most of us believe we know something about how classrooms and lecture halls should be designed. Yet few of us really understand all the factors involved. As students we can recall classrooms that were unsatisfactory; but we are not sure why they were not conducive to learning. What

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this little book offers is a recipe for the design of satisfying spaces for professors and students. You will find detailed descriptions of all the main ingredients for good classrooms: what color walls work best; where video broadcasting equipment should be placed; what proportion of the ceiling should be "hard surfaced"; and even the percentage of the desks necessary for left-handed persons and where these desks should be placed. The details are fascinating and instructive.

I know of no similar book on classroom design, so this manual breaks new ground. This journal has published two fine articles on the subject (Brase 1988; Owu 1992), but the subject has been one of startling neglect despite the million or so classrooms in our schools, colleges, and universities. While one may quarrel with a few of the standards and aesthetic concerns in the book, Robert Allen and his colleagues have identified nearly all the ingredients for successful classroom design. After reading their remarkable little manual, you can create variations to fit your own campus.

Because this booklet was not commercially published, you should know that you can obtain a copy by writing to the Penn State Classroom Improvement Committee, 206 Special Services Building, Pennsylvania State University, University Park, PA 16802. No campus that cares about a better environment for instruction should be without this pioneering manual. ■

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BOOK REVIEW

Everything You've Wanted to Know About Laboratory Design

Guidelines for Laboratory Design: Health and Safety Considerations, second edition, by Louis Di Berardinis et al. John Wiley and Sons, 1993. 514 pages. ISBN 0-471-55463-4.

Reviewed by Michael Reagan, Janet Ross, and Ray Porfilio

Many colleges and universities have science laboratories that were built in the 1970s, 1960s, or earlier, and the labs no longer conform to modern health and safety regulations. What design guidelines for health and safety should be considered if the institutions renovate the labs, or build new laboratories? How should the projects be organized?

Answers to these and other questions can be found in this new book. Written by six eminent health and safety experts, and edited by Louis Di Berardinis, director of the Industrial Hygiene Group at MIT, this dense, well-organized tome is a necessary reference book for any campus facilities planner or architect of academic science projects. We have worked with three of the six authors, and can attest to their expertise and concern for health.

The first hundred pages contain an easy-to-read, meaty discussion of the main elements of laboratory design. These pages will give lay readers and architects alike an appreciation for the complexity of laboratory design. For the later chapters, technical expertise is a prerequisite for interpreting the data and grasping the recommendations. The book is directed more toward scientific research facilities than undergraduate teaching laboratories, but it contains enough information about lab design and construction that it is valuable to a broad academic audience.

The purpose of the book is compelling: to prevent injury and death "by fire, explosion, asphyxiation, poisoning, infection, and radiation." Colleges should emphasize safety not only to educate students in good lab procedures in their scientific careers but also to protect institutions from enormous liability arising from laboratory accidents. The first, 1991 edition of this book contained a thorough discussion of lab design—space allocation, layout, and mechanical systems, and the like—as well as hard-to-find specific data such as clean

Michael Reagan and *Janet Ross* are Principals with Ellenzweig Associates in Cambridge, Massachusetts. Reagan is a graduate of Miami of Ohio who received his M.Arch. from Michigan and did advanced studies at the Architectural Association School of Architecture in London, England. Ross did her architectural studies at Rensselaer Polytechnic Institute in Troy, New York. The Ellenzweig firm has designed many science, teaching, and research buildings for U.S. colleges and universities.

room classification and recommended temperature and humidity for animal facilities. This second edition adds a section on research lab operations and discusses the latest trends in laboratory design such as "variable-air-volume" mechanical systems.

The authors point out that many scientists do not carefully observe the facilities they work in and that few architects are experienced in laboratory design. So they recommend close collaboration, and they offer several clearly drawn laboratory plans, complete with dimensions and descriptive keys. They do not, however, include some trickier aspects of good lab design such as controlled daylighting and the relation of laboratories to support space.

The scope of *Guidelines for Laboratory Design* is ambitious, covering labs for a wide array of scientific disciplines from physics and chemistry to gross anatomy and microelectronics. This edition has a new chapter on teaching laboratories for colleges; but unfortunately it is one of the shortest chapters in the book. For higher education, this is a weakness because there are many new factors that are transforming the design of contemporary teaching laboratories in schools and colleges. Colleges and universities are now building multi-disciplinary facilities, using simulated research environments, inventing prototypes for combination laboratory/classrooms, employing more computers and audio-visual equipment, and installing novel fume hoods. We grant that the topic of teaching laboratories could fill another book, but the 10 pages in this book are unduly skimpy.

Editor Louis Di Berardinis has organized the 514 pages of this book exceptionally well, and provided ample plans, diagrams, tables, and photographs. These strengths, along with a mostly jargon-free text and succinct practical advice ("We do not recommend recirculating air"), make the book readable, helpful, and practical. Yes, the sheer quantity of detailed information may be daunting to those uninitiated in the fields of architecture, engineering, or laboratory design. But for planners and faculty scientists who are responsible for up-to-date and safe labs on their campus, this book is worth studying and keeping on your shelf. ■

BOOK REVIEW

Designing Tomorrow's Laboratories

Handbook of Facilities Planning: Volume 1, Laboratory Facilities, edited by Theodorus Ruys. Van Nostrand Reinhold, 1990. 676 pages.

Reviewed by Larry Anderson

With today's industrial, clinical, and academic laboratories growing in complexity as scientific knowledge expands, the time has come to disregard old conventions for thinking about laboratory planning. We need to embrace fresh perspectives and new frames of reference. *The Handbook of Facilities Planning: Volume 1, Laboratory Facilities* does just this. Twenty four contributing authors and a skillful editor make this handbook a truly major contribution to laboratory facility planning and design. Its carefully organized format and wealth of practical technical tools, design ideas, and planning viewpoints provide a useful working reference for campus administrators, managers, laboratory planners, architects, and engineers.

Editor Ruys, an architect-consultant and vice president of the McLellan and Copenhagen planning firm, defines the point of view from which the handbook took its form by quoting the guru of management Peter Drucker: "Long-range planning does not deal with future decisions, but with the future of present decisions." The importance of this is underscored in the handbook's early chapters which address such issues as communication, perception, judgment and information transfer errors, responding to trends, and determining program requirements and their reliability and validity. Anyone interested in laboratory facilities planning would be well served by reading this book, especially the first three chapters. These chapters expand our insight on how to think about laboratories. They provide important and fundamental heuristics that will guide future decisions in laboratory planning and place in proper perspective the complicated facets of laboratory design.

In addition to technical sections which address laboratory equipment, systems, energy conservation, regulations and standards, the handbook provides appendices that present current information on relatively new and specialized types of laboratories: Radioactive Materials Research Laboratories, Shielded Facilities, Clean Rooms, Biohazard Containment, and Nuclear Magnetic Resonance Laboratories. The subjects are treated comprehensively but succinctly, with just enough detail to acquaint the reader with salient points to consider in design and in assessment of special issues.

Larry Anderson is director of physical planning for the University of Minnesota and a registered architect with 20 years experience. He earned his master's degree in architecture and urban design at Washington University, St. Louis, Missouri. He is a member of the SCUP-27 Program Committee.

endowment, new gifts for the endowment, and an institution's policy of spending from endowment earnings must all assist in maintaining the endowment's purchasing power in a time of fairly steady three to seven percent inflation, while at the same time maintaining the endowment's contribution to annual budget support. In what is sure to be a controversial stand, Massy argues that support of the annual budget should have a higher priority than maintaining endowment purchasing power. To him, the endowment is there to be used, especially when colleges have fiscal troubles. And finally, Massy offers guidelines for the scope of leverage the endowment might provide in support of long-range capital projects.

Endowment is written mainly for college and university trustees who have the ultimate fiduciary responsibility for the prudent management of endowments. But the book will be useful to presidents, financial vice presidents, and budget officials as well since they also require a clear sense of how to use their institution's endowment wisely.

A major strength of Massy's little book is the way he grounds his prescriptions and decision rules in economics. The legacy of Harry Markowitz, William Sharpe, Roger Ibbotson and Rex Sinquefield, John Meck, Peter Williamson, and the Ford Foundation and Twentieth Century Fund studies is reflected throughout the book. Economic principles are too seldom incorporated into the management of colleges and universities, so Massy's book provides a corrective.

Despite its succinct prescriptions, however, Massy's book summarizes more than it innovates. Over the past years I have been asked to assist several colleges as they modernized the management of their endowments. Many, and sometimes all, of the concepts featured in this volume became part of these colleges' new approach. The double-digit inflation of the 1970s and the recent fierce demands to eat into the endowment have prompted many institutions to move toward total return investment management and total-return-based endowment payout under a variety of smoothing constraints. A considerable number of colleges and universities already abide by Massy's advice.

Also, numerous trustees will disagree with Massy's priorities. Specifically, they will probably argue that preserving the endowment's purchasing power is more important than maintaining the endowment's share of budgeted expenditures. Maybe the two—endowment growth to hold purchasing power and funds to meet the escalating annual budget—are of equal importance. Balance is all.

Today, colleges and universities are less inclined toward balance. They operate under fierce pressures to maximize spending from their endowments. Faculty and deans press for additional monies. Some trustees insist on balanced budgets every year regardless. And when market values plummet, campus leaders need their payouts even though current returns are negative. As faculty leaders at one excellent college facing a sudden enrollment decline said recently, "What are endowments for except to be used in times of trouble or extraordinary liftoff?" So perhaps Massy's preference that annual budget support should have the highest priority is in tune with the campus demands of the 1990s.

But if he tilts slightly toward budget support, Massy also insists on endowment management that provides for long-term stability. In these times of acute fiscal stress, however, there seems to be the threefold question of when to begin a new, wiser policy such as Massy recommends, how to phase it in, and over how many years? The questions must be answered because, unless you steer a steady course, your college or university will never achieve the desired objectives. ■

BOOK REVIEW

Controlling the Cost of Science Facilities

Toward More Efficient Building Methods for Academic Science Facilities, by the Higher Education Colloquium on Science Facilities' Task Force on Academic Facilities Costs. Association of American Universities, 1993. 52 pages. LC 93-77023.

Reviewed by Fred Tepfer

Science buildings are expensive and complicated. Once, while working on a large science facilities project, I realized that each day of construction delay costs between $5,000 and $10,000. It didn't take me long to get from there to the realization that if I could shave a week or two off the schedule I could save an amount roughly equal to my annual pay. Of course, that also meant that if I delayed the project by a week, I had wasted a year's salary.

What drives the cost of science buildings so high? They require exotic finishes and systems, high-quality materials, and intensive distribution of utilities. This complexity must be carefully designed, which takes extra time, and it must be carefully constructed, which adds another premium. Also, complexity can breed confusion and mistakes; so corrections during construction add more cost.

Fred Tepfer, A.I.A., is planning associate at the University of Oregon, where he is also an adjunct assistant professor. He earned his B.Arch. from Oregon and practiced as a registered architect before becoming the facilities planner at the University in 1984. He has managed three science facilities projects, and recently did a Bicycle Master Plan. He is also a contributing editor for *SCUP News.*

Not only are science buildings expensive to build, they are very expensive to own. They burn energy like an old house, consume maintenance like an old car, and drink water like an old camel. Even minor remodeling is very costly. And with science buildings, if you blink your almost new facility becomes obsolete. If you then want to convert it to other uses you must spend millions.

The main premise of *Toward More Efficient Building Methods for Academic Science Facilities,* an impressive report written by The Higher Education Colloquium on Science Facilities' Task Force on Academic Facilities Costs, is that "universities can definitely learn from their corporate counterparts" about science building procurement, streamlined decision-making processes, and more efficient design and construction contracting. The Task Force, a panel of administrative vice presidents and planning directors of well-respected universities, directed their report toward senior administrators such as deans and vice presidents as well as facilities planners.

The book is certainly of great value to the facilities planning field, but it is not without flaws. For example, it has a great deal of useful information and important advice for nearly all colleges and universities, but a number of its main points would apply only to our largest state institutions. And its prose is pedestrian.

The Task Force conducted a survey of 89 research universities, 16 design firms, and 9 research-intensive corporations. Although the survey design and data analysis would make any self-respecting social scientist blush (they appear to have written their conclusions, then validated them with the survey) they did turn up some interesting things.

One primary lesson of the report is that academia, as compared to corporations, takes too long to build science facilities, which results in unnecessary added cost because of inflation. This finding is based largely on a study conducted by SARA Systems (the Task Force's survey did not include project duration data). It is easy to discount the corporate model as being inappropriate to academia; but it may be more

Academia takes too long to build science facilities.

relevant than we university planners think. When I plot comparable university projects from my own experience onto the graphs in the report, they fall well within the corporate rather than the academic timelines. Perhaps here in Oregon we don't have the staff or financial resources that would allow the "normal" level of inefficiency that SARA Systems seems to have found elsewhere.

From my own experience it is another concern—that we don't allow enough time to plan science facilities—that is as important as construction techniques. The Task Force doesn't discuss the need to take enough time to do the design job right, time to avoid poor-quality construction documents, and time to design a building to serve the whole institution's long-term needs as well as the immediate desires of the initial occupants.

Despite a focus on the cost of delays, there are many gems (and a few clinkers) in this slender volume, which has the promise of stimulating reforms on many campuses. Gems: learning from other institutions' successes and failures; delegating power to a single institutional representative; hiring designers with relevant laboratory experience; promoting interdisciplinary research and shared facilities; designing for an appropriate level of adaptability to future needs; allowing innovative contracting methods to avoid the quality problems that result from awarding to the lowest bid; designing for long-term value.

Clinkers: the book's three-page Executive Summary, which may be all that some administrators will read. It dwells on less critical areas such as the time-value of money, thus diluting the book's fundamental messages about the need for efficiency and ways to achieve it. Also, the book faults the Americans with Disabilities Act for raising costs by causing apprehension and potential for litigation. This is an uninformed view at best, as higher education has been complying for two decades with standards similar to those of the ADA. The authors criticize asbestos abatement regulations too for adding excessively to the cost of renovations, despite the fact that the cost of abatement has become much more affordable in recent years. Moreover, the book ignores the challenge of designing buildings whose materials and systems as yet don't present health risks according to current standards. What will be the asbestos scare of the next decade? Indoor air quality? Lead-based paint? Safety considerations in lab design? Magnetic fields? Seismic risk?

If your institution has an overly complex, bureaucratized facility design and construction system, if you are hamstrung by intrusive or obstructive state rules and regulations, if you have been burned by claims and lawsuits from incompetent contractors, or if you have been frustrated by internecine bickering among academic departments, then this pamphlet is the perfect tool for initiating reform. Buy a stack of these books and give them to your vice presidents, deans, department heads, and any others who may have the clout to improve the system. Or if you are a facilities planner embarking on a science building project but don't have much recent experience with laboratory work, by all means read this book. It will certainly save you many thousand times the six-dollar investment.

Deep down in the Task Force's long list of largely excellent recommendations is a very important section on life cycle costs and the need to consider the costs of ownership as well as the costs of construction. The sad truth is that life cycle cost analysis gets more lip service than practice. Universities will nearly always build to the limit imposed by the project budget. If they do so efficiently they will receive in return larger and better buildings. If they do so inefficiently smaller and poorer facilities will result. However, bad decisions about building systems and materials will remain costly for decades. Rigorous mathematical application of life cycle cost analysis is not always appropriate or necessary; but it is all too common to find institutions that are being drained financially by the ownership costs of a new building because they neglected to consider future costs during design. This can and should be prevented.

The consortium has done higher education a service in developing this publication. It doesn't offer startling new information for experienced facilities planners working in the trenches, but it does give them a tool for educating the rest of the institution about how facilities procurement can be improved. Nearly all the recommendations apply equally well to non-science buildings such as libraries, classroom buildings, and residence halls. ■

IV. Student Spaces

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Suddenly the design of college residence halls has become a new priority.

New-Wave Student Housing

Earl Flansburgh

Americans have become more deeply concerned about higher quality in higher education. And several studies have shown that residential living can increase the quality of learning. But there are other factors too that suggest that attention to student housing may be one of the most significant matters of the 1990s. Colleges and universities should be planning now for the new demands for improved residential living.

For one, off-campus housing in many areas is getting scarcer and more expensive. On a national scale, U.S. housing starts and apartment construction did not keep pace with family formation in the 1980s. In 1989, for example, there were 2.4 million marriages, according to the National Center for Health Statistics, but only 1.38 million housing starts. With more families competing for housing units, the inevitable inflation has taken place. And families have been competing with students for these units. Landlords, given a choice, will frequently take couples, who are perceived as more stable and quiet, over students, perceived as more disruptive and noisy. The growing problem of off-campus housing is often particularly acute—and time-consuming for students—where the college or university is located in a small town or residential suburb. In cities, the problems of public transportation, safety, and parking, have made off-campus housing less attractive.

Another phenomenon begun in the 1980s is that an increasing number of students want to live on campus. Unlike the 1960s and 1970s, when students often wanted to get away from authority and community, today's students seem to have rediscovered camaraderie and the pleasure of getting to know new and different colleagues.

An additional factor is the intensifying competition for good students. As the applicant pool for traditional undergraduates—and graduate students—has declined, and will continue to decline until the mid-1990s, colleges doing market research have learned that the lack of attractive quarters in which to live is often cited as an important element in college choice. Institutions are being forced to provide better residential spaces to attract and keep the students their faculties want.

Earl R. Flansburgh, FAIA, is president of a Boston-based architectural, master planning, and interior design firm. A graduate of Cornell and MIT, he has taught architectural history at Wellesley and design at MIT. His firm has designed more than 300 educational facilities, including a new law library and master plan for Boston College Law School and a residence hall-dining hall at Worcester Polytechnic Institute that recently won the Walter Taylor Award as the best U.S. educational building of the year.

Attractive quarters in which to live is often cited as an important element in college choice.

Also, as universities become more diverse in their student population, with more minority students, sons and daughters of Asian and Hispanic immigrants, and foreign students, campuses are rethinking what this requires in student living arrangements, food in the dining halls, and support facilities. Should there be Third World houses, foreign language houses, an international house, and gender-specific housing?

But perhaps the biggest factor compelling a new look at student housing in the 1990s is the revolution in what students do in a dormitory room today as opposed to a decade ago. More about this major change a little later.

Renovate or build?

For all these reasons, and others, colleges and universities should be giving renewed attention to campus residences. But should colleges renovate existing dormitories or build new ones?

The renovation of old residence halls may be desirable if the buildings are well-built, reasonably spacious, and not too old. Renovation may be almost obligatory if the buildings form an integral part of the college's traditions. Sensitive and ingenious renovations can maintain the aesthetics and charm while introducing 21st-century features.

However, it is important to realize that

Figure 1. Founders Hall at Worcester Polytechnic Institute. This award-winning design comprises several residences around a dining hall (at the left). The buildings are broken into separate structures to fit in with the residential nature of the surrounding neighborhood.

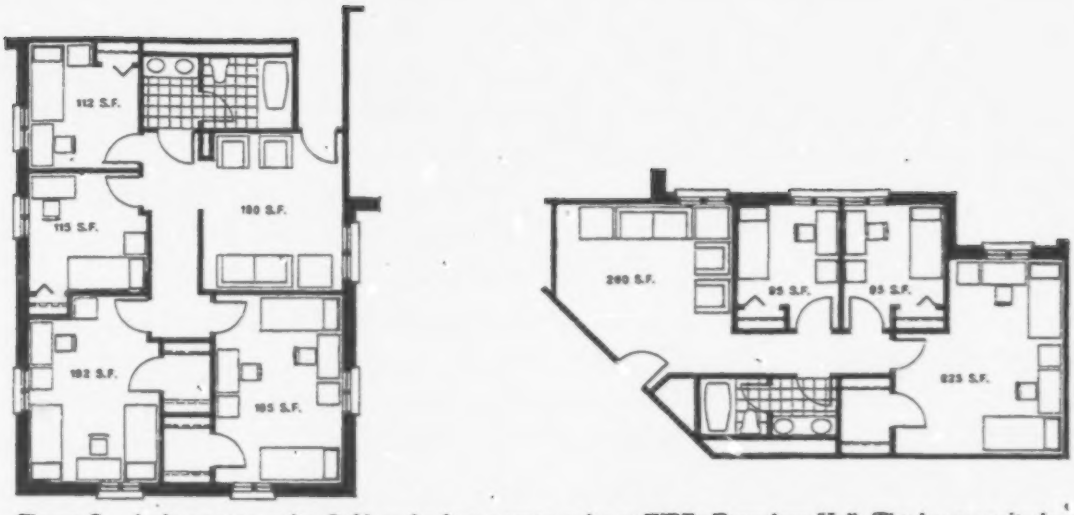

Figure 2. A six-person-suite (left) and a four-person suite at WPI's Founders Hall. The larger suite has two doubles and two singles; the smaller suite has one double bedroom and two single bedrooms.

renovating an old residence hall can approach the cost of new construction, or actually exceed it. Many existing dormitories must be extensively remodeled to be brought up to the same building code as new buildings. Existing residences often do not have adequate access for the handicapped, or fire stair enclosures. Back-up emergency lighting and generators are often antiquated. Also, some older dormitories are constructed of wood which is not adequately fireproofed. If the work also includes the removal of asbestos, renovation costs can be startling.

If a university decides to build, it may believe that hiring an experienced residential building developer will allow them to provide residences for students more economically. Sometimes construction by private developers has been fairly successful. But speculative developers will usually build to standards of quality different from those an educational institution deems appropriate. The college will usually have little control over the design. And the institution's tax-exempt status may be called into question by a private development project. A for-profit developer building on non-profit land may find the project taxed, particularly if the developer owns the building for a period of time. The legal aspects of private building for collegiate use can become exceedingly complicated in some communities.

So it is usually advantageous for a college or university to study seriously the creation of its own new residence halls. Financially it is appealing because such buildings produce revenue that will amortize the mortgage. Residence halls are frequently an attractive gift for affluent and loyal old graduates. Many states also have low-interest bonds that help colleges finance student housing.

It is important to bear in mind, however, that residential housing projects on campus seldom break even for the first three or four years. After the first three or four years, with modest inflation, revenue from student housing will slowly begin to exceed running costs slightly.

I think that a college or university planning for increased excellence in the coming decades should in nearly all cases where renovation is not necessary for strong historic or aesthetic reasons build its own housing for students. Student residential space should reflect the special nature and culture of the institution, and should be used to enhance the quality of total learning on campus.

What kind of residences?

In planning student residences, one of the fundamental questions is how large a group of students should be combined in one facil-

ity. There are several opinions on this matter, some based on sociological studies, some based on economics, and others based on long experience. Sometimes the institution's tradition in student housing will argue for a certain size. For instance, Smith College, the noted women's college in western Massachusetts, has a tradition of small houses, so the Friedman House residences our firm built there are tiny townhouses for four students each. Urban universities often have high-rise dormitories.

How large a group of students should be combined in one facility?

My view is that, if land permits, housing students in groups of approximately 200 works best—in terms of student friendships, economics, and human scale. If at all possible residence halls should be limited to four floors of rooms. Higher than that requires elevators, which should be avoided as the primary means of circulation. Circulation of students going to classes is a major problem, especially in the mornings, or at evening meal; elevators cause delays and vandalism because they cannot handle crowds at one time. If you are building for many students, it is best to build multiple structures of 180–200 each.

What about the number of students per room? Most college administrators think that either individual rooms or rooms with two students are preferable. I agree. Rooms with more than two students should be avoided because three or four students in a room makes studying extremely difficult.

A second question for basic unit planning is whether the residence hall will have rooms along a corridor (hotel-style) or suites (several single or double rooms built around a central, shared living space).

Single or double rooms on either side of a corridor is an economical form. But it does little to enhance collegiality, and done properly for students is not quite as frugal as many believe. What happens with undergraduates, especially males, is that the corridors get used as a common room, or even a playing field, for "corridor hockey" and other games that energetic young students devise. The hallways thus receive lots of abuse. The carpet on the corridor floors needs to be replaced every three or four years; the corridor walls should be brick to handle hard pounding; and light fixtures should be sturdy. I think corridors should have some windows to the outside too.

A suite is really an apartment without a kitchen, built to accommodate two, four, or six students. They should not be designed for three, five, or seven students because many years of experience and some research have shown that an odd number of students usually isolates individual students while pairs enhance friendship. The bathroom in a suite should be divided into two or three spaces, with shower and wash basins separated, to handle peak-hour usage.

Some universities are building residence halls with suites containing small kitchens and dining areas so that the residences can be converted if need be to conventional rental apartments, open to tenants who are not part of the university, should student interest in on-campus housing decline sharply. I think that in most cases this is not a good idea. Kitchens are expensive. They attract insects. Keeping them clean in a suite leads to arguments. And kitchens in dorms prevents students from dining together with others and learning from them.

The problem of room size

The size of the student room is always an issue. Students and residence halls administrators want the largest rooms possible; the college's business manager wants the most compact and economical space. As a compromise, most single study-bedrooms should have a net (inside the walls) area of 105 to 115 square feet, or roughly a 9 × 12 layout. Two-person rooms should have a net area of 190 to 210 feet. These sizes are compact, but have space enough for some flexibility of layout. Some colleges or very budget-con-

Figure 3. The Friedman House at Smith College—townhouses for four students each—were tucked into spaces among existing buildings in the residential neighborhood.

scious state universities build smaller rooms, but this often results in inflexibility of layout, student complaints, and a damaging of the walls; and it actually provides only limited dollar savings.

If anything, student rooms for the future should be larger. Nothing has altered the way our society operates—and the way students work—as much as the personal computer. Computers have transformed the uses of dormitory rooms. This requires colleges to rethink the space and facilities students need.

Compact computers have had an impact on dormitory rooms in two major ways. They demand additional space for the com-

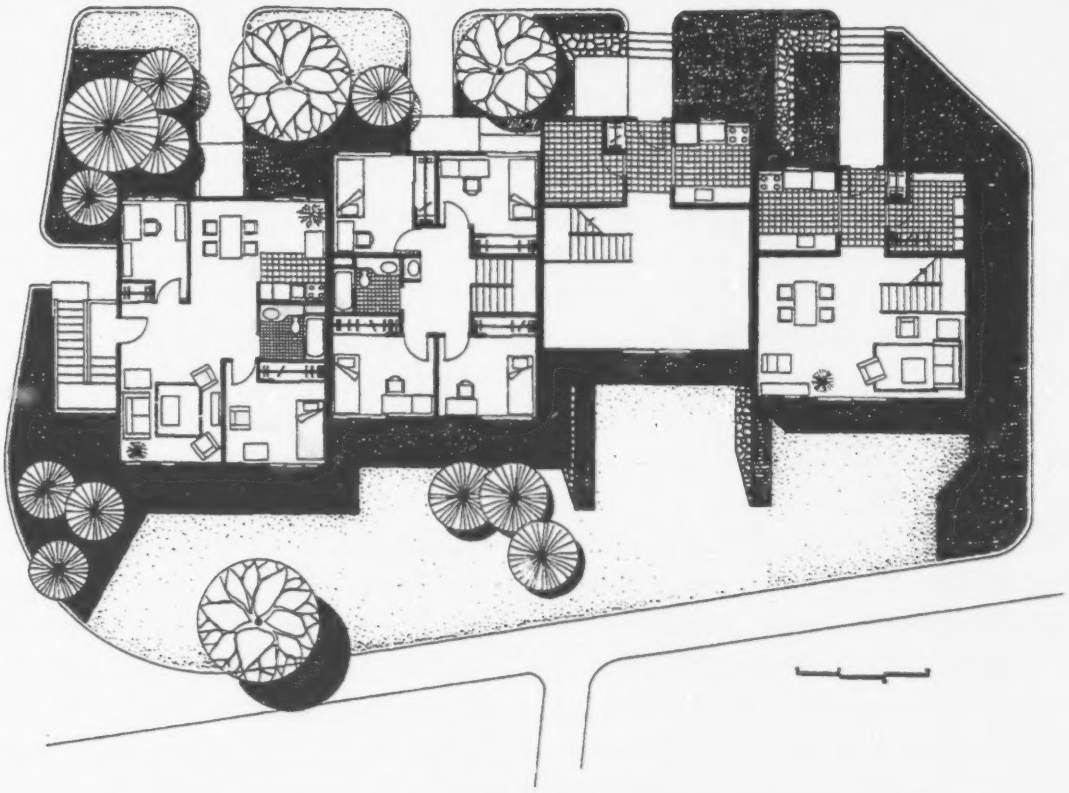

Figure 4. Floor plan of Smith College's Friedman House. Note the ample common room space.

puter and printer and they contribute to a significant increase in the needs for electrical power and outlets. The screen, computer terminal, and printer occupy an area of approximately two feet by four feet, not including space for the seated student. Student rooms for the future need to be designed with a computer and printer in mind.

The presence of the computer, and other new electrical items, also mandate that new residence halls be designed for a significant increase in electrical power. Students today arrive on campus with stereo systems, small television sets, VCR's, hair dryers, electric shavers, radio/alarm clocks, portable irons, coffee makers, lamps, and even toaster ovens or microwave units, as well as computers and printers. Yet the current electrical code requirements for a bedroom indicate only one duplex outlet for each wall. This is barely sufficient for single-occupant rooms. For two-student rooms, the code minimum number of outlets should be doubled so that there are four duplex outlets for each student. In addition, telephones should be installed in each room, and cable TV hookups are now almost obligatory for new residence halls.

The widespread use of computers by students also means that the residence halls need to be designed to handle power interruptions. It is not uncommon to have power halted by an event in one of the rooms. To contain the power disturbance so that it affects only one suite and not the entire dormitory, a small circuit breaker box should be installed directly adjacent to the entrance of each suite. This will ensure that a short circuit in one room or suite does not "dump" all the computers on the floor.

Handling noise

The popularity of rock-and-roll music, often played at high volume, requires that colleges pay greater attention in the new residence

halls to sound muffling. In planning dormitories and residence halls, it is important to provide as much acoustical isolation as possible. That is not easy.

The physics of acoustics is relentless. A wall between two spaces with a one-inch-square opening or the equivalent of a one-inch-square opening, where air can filter from one space to another, has 50% of the effectiveness as a solid, airtight wall. Therefore, a good starting point in acoustic isolation is to make sure that there are no openings between one space and the adjacent space. That means no openings under doors, no pipe openings in a wall, and no duct openings between two spaces.

When two spaces are adjacent and there is no possibility of air transmission, there is still a problem with the vibration of the common partition or floor. In other words, a student who turns a high-fidelity system up to 60 or 80 decibels will vibrate the walls, floor, and ceiling of the space, which in turn will vibrate the spaces next door, above, and below. This vibration of surfaces causes sound transmission. One way to mitigate that sound transmission is to increase the mass of the floor, walls, and ceiling. Higher mass allows less substantial vibration, and therefore less transmission of sound.

In addition to mass isolations, vibration of the walls of adjoining spaces can be diminished by ensuring that there is limited or no structural connection between the wall in the space with the student and the hi-fi system and the wall in the adjoining residence unit. This means that the studs that hold up the finish side of the partition in the rooms with the music do not touch the studs in the finish wall treatment of the wall in the adjoining room. This system, called "staggered studs," reduces the problem of sound transmission by isolating one space from another.

The third method of limiting sound transmission is through planning. This means that you do not place the room that is likely to have the greatest amount of noise, such as a living room, next to a room where quiet is desired, i.e., a bedroom, but rather next to another space that is likely to be noisy, i.e., a living room. So in planning dormitories and residence halls, living rooms are placed adjacent to each other and bedrooms are placed adjacent to each other wherever possible. This type of preventive design reduces the amount of disturbance from one space to the next.

In fact, acoustic isolation is best achieved by embracing all three of these processes of wall, floor and ceiling mass, of isolation, and of planning.

Non-living spaces

For any college desirous of encouraging exchanges among its students, the design of common spaces, or lounges, is a major matter. Residence halls usually have two kinds of lounges for informal social interaction. One is the "destination" lounge, the large space adjacent to the front door of the building or a closed space on each floor of the hall where students may gather. The other is the "circulation" lounge, an attractive space to intercept students along the corridor or next to the stairway or elevator. Circulation lounges on each floor are particularly important in buildings with rooms along a corridor instead of suites with a common living room attached to the room groupings.

Computers have transformed the use of dormitory rooms.

Too often lounges are cold and utilitarian and the furniture tacky. To be sure, lounges need to be durable because of hard use. But they should also be home-like. The large entry lounge to a residence hall especially should be handsome and inviting, with plants, rugs, and excellent furniture. For students it is a major place to meet and talk.

Another common room in most contemporary residence halls is the laundry room, which on some campuses has become a new social center. Students today prefer to do their own laundry. Given the semi-social nature of the use of this facility, colleges should

try to locate the laundry room adjacent to the "pub" or the vending machine area, and seating should be provided. An important design element of the laundry, pub, or vending machine areas is the acoustic isolation of the noisy activities from student work and sleeping rooms.

The design of dining halls is of immense importance.

A third common room that is gaining popularity fast, and will probably be a fixture of the 1990s, is the weight room. Physical fitness, weight control, and aerobic exercise are no longer only for athletes. I think each 200-student residence should provide for a weight room with appropriate exercise equipment. Here again sound isolation is important in the construction of these spaces.

A fourth kind of common room is the television lounge. Television has become a ubiquitous part of our daily life. But the television rooms of the 1970s residence halls need to be replaced with large TV screens in the lounge spaces, without separate TV rooms. Today most students have small TV sets for their rooms, and casual viewers stay in their own rooms. But large groups of students still gather for elections, extraordinary news happenings, major athletic events, and other special moments, and this requires a TV screen in a lounge area for dozens of students.

The storage issue

Since dormitory rooms, for economic reasons, are relatively small, residence halls of the future need to provide more storage space in the building than in the past. Not only do students now need a place to store out-of-season clothing, but they also need storage space for bicycles, skis, roller skates, knapsacks, climbing equipment, and similar items. Residence halls are home to students nine months of the year, and their homes contain more possessions than in the past. Failure to provide adequate central storage space means that students construct their own makeshift forms of storage in their rooms or in the outside hallways.

Bicycles have become especially popular. Residence halls of tomorrow will need bicycle racks near the entrance of each dormitory so that students can have easy deposit and access. Providing shelter from rain or snow for the bicycles next to resident halls' entrance is a considerable design problem.

Where to eat?

The dining hall, of course, is a very important space in student life. Many of us remember impassioned discussions over a meal in college as we debated the way we would settle world issues, interpret an author's writings, or determine what is reality. Ideas get shaped and lifelong friendships are made in college dining halls and pubs. Their design is of immense importance as colleges seek to enhance out-of-class learning and unite resident and commuter student populations.

Should a college have one huge dining hall? It depends on the size of the college. Small colleges under 1000 students probably should. Larger colleges and universities cannot. Huge, cavernous dining halls should be avoided; smaller ones that seat 200 or so students are preferable because they encourage intimate exchanges. (Each 200-seat dining room serves roughly 400 students.) Smaller dining rooms are now possible because of the increasing use of a central preparation kitchen on campus, with warming kitchens in each dining hall.

Everything affordable should be done to make the dining halls not only a warm, attractive place to eat but also a pleasant place to have vigorous discussions, meet fellow students, and contemplate significant issues. Window treatment to provide lovely views needs attention. The aesthetics of the interior, the acoustics, and especially the lighting in the hall are design elements that require artful and sensitive handling. The table groupings should have variety, from small tables for two to one or two long tables for a

team, sorority, or chemistry class; but many tables should seat six to eight students to encourage new acquaintances and group discussions.

Today's students frequently "graze," or eat small meals at odd hours from early morning to midnight. This has led some universities to install fast-food franchises in their campuses. While this may be financially helpful, conviviality and good nutrition are often sacrificed. The "pub," as it was called before the national drinking age was raised from 18 to 21, is preferable as a gathering spot for after-hours eating, drinking, and talk. Again, durable, comfortable furniture and a lighting level that encourages intimacy and conversation should be provided for this important, informal gathering place.

Those other spaces

What about apartments for resident advisors, or RA's? Or a large suite for a faculty family? Or classrooms or seminar rooms on the ground floor of the residence hall?

I think that planning a residence hall must include suites for the resident advisors. The sheer animal vitality and emotional turmoil of young students need to be proctored by older, stable students. Since the resident advisors have an ombudsman's role, their suites require a small room for private and often intense conversations.

Faculty suites in student residence halls have not worked well. Faculty are reluctant to accept such living accommodations, and the institution usually needs to provide additional money for the faculty family's "real" home elsewhere. (Faculty apartments adjacent to residence halls work better than those in the dormitory.) Classrooms in the dormitories have a similar record. Residence halls are usually located at the perimeter of the campus and professors—and students—tend to prefer classes near the professors' offices, which are normally in the heart of the campus.

One of the most perplexing problems of modern universities is providing parking for students. Students will often not use their cars for a week or two at a time, but they want them nearby when they do need to use them. There is no easy way to solve this vexing problem. Solutions vary from campus to campus. At some institutions multistoried parking garages have been built, but these are not economically feasible for low-cost student parking.

Planning for residence halls should take into account the need for outdoor recreational spaces that allow students to spill out from the building onto a terrace, a pleasant balcony, or a small grassy playing field. These too help build community and increase retention.

The way students live and work today is different from that of the past.

Should tomorrow's residence halls be air-conditioned? Air-conditioning is almost mandatory for college dormitories in the southern half of the United States, but it is an arguable installation in the northern climates. Each college needs to ask itself how it will use the residence halls in the summer. If they will be used heavily for the whole summer, air-conditioning may be economically feasible.

Seeing residential life whole

Too often college and university residences have been treated as unfortunately necessary and utilitarian structures. Amenities, student needs, and the many opportunities for creating a more studious, more friendly body of students have been overlooked.

But campus residence halls are home for students for four years, or two or three years for graduate students. They are not normal homes with families, but with a special peer group home of energetic, bright, adventurous, and sometimes frustrated students. So durability, control of acoustics, and arrangements for group encounters are essential. The rules of standard residential construction and design need to be altered so

that colleges can, in an economical way, provide the optimum conditions for higher learning—and for bonding affectionate alumni who will help support the college in future decades.

The way students live and the way they work intellectually today is different from that of the past. Colleges need to build new kinds of dormitories for the electronic age, and for achieving the higher retention and quality of learning the public now expects. Residential renewal and new construction should be a major part of planning capital facilities improvements in American higher education.

Winston Churchill once said (of his House of Parliament): "We shape our buildings. Then our buildings shape us." For college residence halls this seems a basic truth. ■

A change in undergraduate interests has created a new kind of campus building.

The Outburst of Student Recreation Centers

David Body

During the past 15 years a new kind of building has begun to appear on campuses. It is becoming a feature at large and small universities and has started to appear at some private colleges and community colleges. The buildings are called student recreation centers, wellness centers, or centers for student physical activities.

The student recreation center is neither like the gymnasiums that have been part of campus life for a century, nor like the student centers built in the post-war years to be hubs of undergraduate social and extracurricular life. Yet they incorporate parts of both. These earlier buildings were designed to serve a different set of students. Athletics was less prominent, and women's sports programs were minimal and frequently housed separately. The lines between intercollegiate competitive sports and recreation and intramurals were not as clearly drawn. Intercollegiate sports were not the subject of present-day media scrutiny, and the expectations of players, coaches, and spectators were lower with regard to the quality of playing surfaces, lighting, safety zones, seating, sight lines, and restrooms.

The student recreation building of today is a far cry from its predecessors. And it is increasingly regarded not as a non-academic luxury but as an essential structure for the education of a young person's body, mind, emotional qualities, and self-discipline. It is also seen as a preventative health resource—a wellness center.

A good number of the early gyms were architecturally delightful, as evidenced by the conversion of some into art or computer centers or into libraries. But most athletic facilities have become dinosaurs, with unsafe pool depths, labyrinthine circulation patterns that make them impossible to secure, with code and ADA deficiencies, and with inadequate spectator space. Yet what principally caused the explosion of the new recreation centers were several major shifts in students' values, mores, and interests.

Propellants for the emergence

In my judgment, four big changes gave impetus to the development of student recreation centers as we know them today.

David Body is the principal-in-charge at Cannon-Parkin for master planning, programming, and design of sports facilities, for which the firm is noted. A graduate in architecture from England's University of Sheffield, he is a former Canadian Tennis Open and California State Squash champion and has played lacrosse and paleta argentina at the international level. He has visited and consulted on sports facilities on four continents and worked for more than 40 colleges and universities nationwide, has lectured at Harvard and the University of Arizona, and has been a leader in the design of the modern student recreation center.

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1. *The increased quantity and quality of intercollegiate sports competition.* More of the sports now require year-round practice and training and place impossible demands on facilities shared with recreational users.
2. *The large increase in participation by women* in athletics, exercise, aerobics, recreational games, and after the passage of Title IX in 1972, in intercollegiate competitive sports (Emmons and Wendt 1996).
3. *The extraordinary growth of student interest in fitness and regular exercise.* Beginning in the 1960s with President John F. Kennedy's advocacy of fitness programs, and medical research on the causes of heart disease and obesity, undergraduates have now made better health, nutrition, and physical fitness an integral part of their weekly lives. Many faculty and staff have done so also.
4. *An expansion of the number of students who demand facilities for individual or small pickup-team recreation at nearly all hours.* From early morning swims or runs to lunchtime or midnight basketball, volleyball, squash, or ice hockey, today's undergraduates want to engage in exercise or athletics between long sessions at the computer, in the classrooms, and in the library. Significantly, they are even willing to put money up for the new facilities, often in the form of a student fee to support a bond issue.

These four changes and the resulting space requirements at first led to design responses to meet the new program requirements. Often the responses took the form of a multi-purpose facility where the emerging recreational component was located around and under the seats of a spectator facility. Examples of such design projects include the 1973 Recreation Hall at the University of California, Davis, and the facility at the University of Southern Illinois. The University of Washington in Seattle also built a single-purpose recreation and intramural structure during this period.

Then in the late 1970s and early 1980s some serendipitous liaisons occurred which led to the birth of the contemporary recreation and health center. Students grew more insistent. Recruited athletes became more demanding. Faculty and staff too began fitness regimens. Some campus administrators grasped the new national interest in exercise, fitness, wellness, and around-the-clock recreation and impromptu games. And some

Undergraduates have made better health and fitness a part of their lives.

architects realized that something new —not just a larger gym or field house, or a student center with fitness rooms added—was required. One early prototype was UCLA's John Wooden Center, which opened in 1983. Here a visionary recreation director, the health-conscious California environment and their assertive student leaders, and a pro-health and recreation chancellor collaborated closely with the campus architect and a specialized consulting architect to create a new kind of campus facility.

When the Wooden Center design began in 1979, there was a good deal of searching for the forms that would embody the new intensity of physical activity on campus. But gradually the program for the building and the design came together. The exterior materials may reflect the university's budget constraints, but the organization of the interior spaces and general ambiance represent a breakthrough. The controlled single point of entry to the building, the greater clarity of circulation, the visual links between activity spaces, the introduction of natural light into the interior, carpeted floors and contemporary colors, glass-walled courts, ample lounge spaces, and original artwork are now all accepted as design standards for recreation centers. Other early examples of the new genre may be found at Texas Tech University, the University of California, Berkeley, and St. Mary's University in Halifax, Nova Scotia.

Recent Student Recreation Centers

Project	Year Opened	New AREa GSF	Other Recreation Facilities	Spectators	Pools	ICA Component
ARIZONA STATE UNIVERSITY Student Recreation Complex	1989	150,000	Yes	No	Outdoor Recreation	No
LOMA LINDA UNIVERSITY Drayson Center	1995	98,000	No	No	Outdoor Recreation	No
MISSISSIPPI STATE UNIVERSITY Sanderson Recreation Center	1997	160,000	No	No	Indoor Comp./Rec.	No
OAKLAND UNIVERSITY Student Recreation and Athletic Center	1998	260,000	No	3,000 Main Gym	Indoor Comp./Rec.	Yes Div. II
POMONA COLLEGE Rains Center	1989	86,000	No	1,800 Main Gym	Outdoor Comp./Rec.	Yes Div. III
RANDOLPH MACON COLLEGE Sports and Recreation Center	1997	70,000	Yes	No	Indoor Comp./Rec.	Yes Div. III
UNIVERSITY OF ARIZONA Student Recreation Center	1990	120,000	Yes	No	Outdoor Recreation	No
UNIVERSITY OF CALIFORNIA, LOS ANGELES Wooden Center	1984	100,000	Yes	1,800 Main Gym	No	Some Div. I
UNIVERSITY OF CALIFORNIA, RIVERSIDE Student Recreation Center	1994	89,000	Yes	3,000 Main Gym	No	Some Div. II
UNIVERSITY OF CALIFORNIA, RIVERSIDE Student Recreation Center	1994	89,000	Yes	3,000 Main Gym	No	Some Div. II
UNIVERSITY OF CALIFORNIA, SAN DIEGO Recreation Intramural Athletic Center	1995	188,000	Yes	4,000 Main Gym	No	Yes Div. III
UNIVERSITY OF GEORGIA The Ramsey Center for Student Physical Activies	1996	384,000	No	2,500 Volley Ball 3,000 Swimming	Indoor Comp./Rec.	Yes Div. I
UNIVERSITY OF MIAMI George A. Smathers Student Wellness Center	1996	114,000	Yes	No	Indoor Recreation	No
UNIVERSITY OF SOUTHERN CALIFORNIA Lyon Center	1989	80,000	Yes	1,800 Main Gym	Adjacent 1984 Olympic Pool	Some Div. I
VANDERBILT UNIVERSITY Student Recreation Center	1990	130,000	No	No	Indoor Recreation	No

The basic elements

Since the mid-1980s the design of student recreation centers has evolved. The type, quantity, and size of spaces vary widely. The programs have been influenced by factors such as an institution's enrollment, commuter or residential campus, other existing athletic facilities on campus, geographical location and climate, the regional recreational sports, the number and type of intercollegiate sports, size of the surrounding community, and the funding available. But many elements have remained constant.

- A single, controlled access entrance/lobby equipped with computer-monitors with the numerous required exits alarmed and enunciated to the control desk.
- High-bay court space for basketball, volleyball, badminton, indoor soccer, etc.
- Weight training and exercise rooms with free weights and cardio-vascular equipment.
- Racquet courts for squash, racquetball, and volleyball.
- Multi-purpose rooms of varying sizes for aerobics, combatives, yoga, Tai-chi, etc.
- Indoor elevated jogging track.
- Administration offices and conference spaces for sports and recreation staff and for student clubs.
- Locker/shower rooms, with separate facilities for men, women, faculty, and staff.
- Equipment checkout and storage, and sometimes laundry facilities.
- Lounge spaces, because the center has increasingly become the campus social center.
- An aquatic facility. The large universities with an intercollegiate swimming program have a competitive facility, with a 50-meter constant-depth pool, diving well, and practice tank, allowing the separate recreation pool to be sized for instructional swim classes and recreational uses such as lap swimming, inner-tube polo, and water basketball. The recreation pool may also have a zero-level (beach) entry, shallow water for instruction and water aerobics, deeper water for scuba diving

Photo Credit: Christopher Barone

Exterior of the Drayson Center for student physical activities and recreation at Loma Linda University, near San Bernadino, California.

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and life saving classes, and more convenient access for disabled persons.

At smaller universities and most colleges both the pool and the gymnasium are often shared by intercollegiate competitive teams and recreation-seeking students. The design challenge of meeting the conflicting needs of competitive sports and "fun" recreation is difficult, but it is being resolved in creative ways nationwide. Not only must the design of the pool itself accommodate both swimming and diving competition and student recreational uses, but the issue of spectator facilities and access must be addressed. For gymnasiums too, most colleges must combine the uses of intercollegiate competition, intramural, and recreational activity—and, at other times, events such as concerts, dances, and ceremonies.

The design challenge of meeting the conflicting needs of competitive sports and recreation is difficult.

Fortunately, the greatly improved technology of retractable seating, and motorized curtains and backdrops, have facilitated such shared use. For example, the University of California, San Diego, has recently completed a facility accommodating 4,000 spectators for an athletic event, all on retractable seats. When the seats are fully retracted, the floor area released holds five recreational basketball courts. At UCSD an auxiliary gym actually makes basketball hoops available to recreational users even during an intercollegiate game.

The financial impact of accommodating spectators in a student recreational facility that is required to be open at all hours should never be underestimated. Provisions must be made for a lobby with ticket booths, multiple easy exits, concessions, numerous restrooms, press and TV space, team rooms, coaching offices, significant storage space, and additional circulation without impacting the facility's recreational use unduly.

As student interest in new forms of health maintenance, recreation, and intramural competition continues, campus and outside architects must also consider secondary spaces, the inclusion of which usually engenders debate during the programming phase. Such spaces include a wellness center, climbing walls, saunas, a cardio theater, rooms for

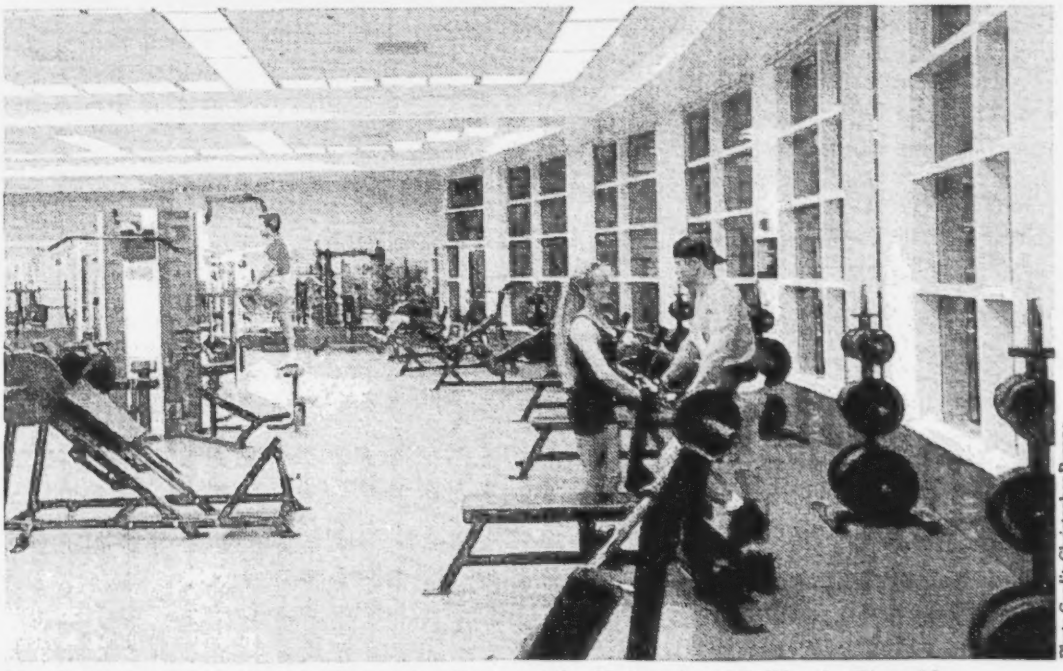

Photo Credit: Christopher Barone

The fitness area at the Student Recreation Center at the University of California, Riverside.

gymnastics or dance, MAC's (multi-use athletic courts with dasher boards similar to those in hockey rinks), a first aid room, and—yes—computer study rooms.

Location, location

Where should the student recreation center be located? After all, the building has an architectural mass that is difficult to insert graciously into the human-scaled heart of the campus. Parking needs, the spectator flows, and other considerations would seem to suggest a peripheral location. Also, if the recreation center is open to the local community in early mornings and other offpeak hours to generate some revenue, that too suggests a perimeter location.

However, this new genre of building has become more and more the social center as well as activity center of the campus; and students, faculty, and staff like to enjoy a more central facility that permits a fairly quick return to academic work and chores. So institutions such as the University of Miami, UCLA, and the University of Southern California have located their recreational centers on the central campus. But other universities from the University of Georgia to the University of Arizona have preferred an outer site.

Another frequent planning debate is whether to construct a single, large facility which allows the entire campus community to meet in one location or to build several satellite buildings around the campus, related to playing fields, parking fields, or student residential houses. The University of Virginia, for example, has chosen to develop satellite facilities. This scattered approach has significant management implications, and at Virginia at least it has resulted in a degree of "ownership" of the facilities by discreet community segments. Also, some colleges and universities choose to have separate facilities for individual competitive and recreational sports: a Tennis and Racquets Center, a fieldhouse, or a Natatorium for all water activities.

This leads to the question: What is the appropriate size for these new campus recreation centers? This is a difficult question to answer. As I noted earlier, it depends on the size of the university, whether spectators and community persons are introduced, whether one or two swimming pools are included, and more. It may also depend on the formulas of the state officials or some generous alumnus. Indeed, size is most frequently driven by the available funds.

Frequently a college or university will base its decision in part on comparisons with peer institutions, but unfortunately

Where should the student recreation center be located?

there is considerable misinformation about the square-foot cost of student recreation centers, even centers which have been built. The discrepancies stem not only from the bid date, zone of country, whether the site is complex, self-contained, or served by a central plant, and exclusive or inclusive of site development costs, but also from the confusion between construction cost and

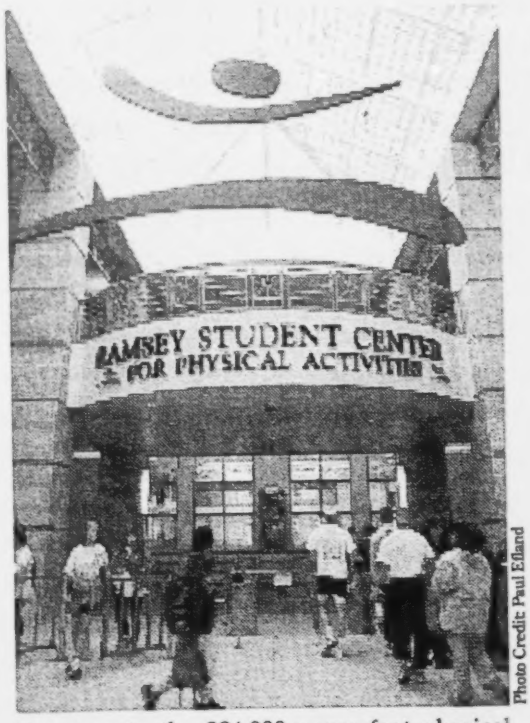

Photo Credit: Paul Efland

Entrance to the 384,000-square-foot physical activities center at the University of Georgia, which more than 5,000 students use each day.

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total project cost, and between assignable area and gross area, which can result in bizarre square foot numbers. Campus architects and administrators need to take great care to avoid inaccurate budgeting at the start of the project.

How much should a college or university plan to budget for a new state-of-the-art recreation center? In my experience, it is difficult to construct a building that provides for the full range of today's preferred activities for less than $8 million. The majority of projects I know of have fallen within a cost range of $8 million to $30 million, with projects for a large university that include a separate competitive pool and considerable spectator facilities at the high end.

Are these new student recreation centers worth the expense? One way to get an answer is to visit these centers and observe the traffic. The University of Georgia's Ramsey Center has averaged 5,500 visits a day since it opened; that of smaller Loma Linda University's Drayson Center has averaged 1,500. The center at Arizona State University is usually filled until midnight. Obviously the recreation centers respond to a new desire by many young people and adults to keep themselves fit, agile, healthy,

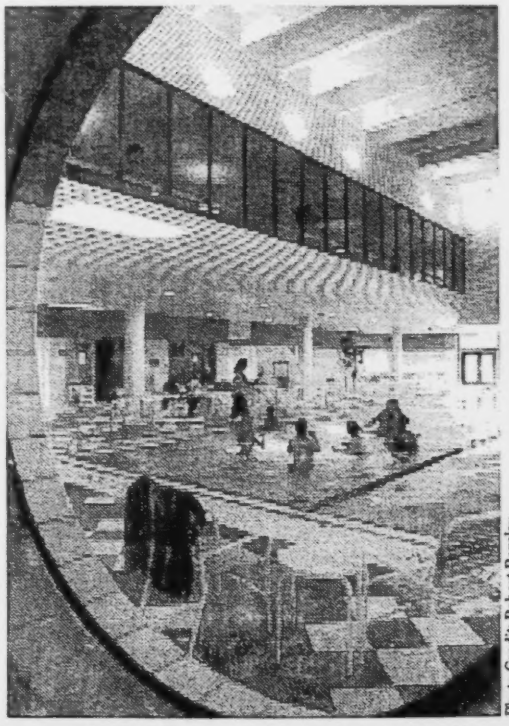

Photo Credit: Robert Barclay

Recreational pool at the Student Activities Center at Central Michigan University, looking through a hallway window.

Are these new student recreation centers worth the expense?

and strong. The recreation centers teach healthy lifestyle habits, preventative medicine, safe and fair competition. The facility is a valuable tool for recruitment and for retention. It is a place where students, faculty, and staff—and perhaps alumni and others from the surrounding community—can meet, workout, and play together. Also, for architects the centers are a new challenge and great fun to design.

Looking ahead, campus leaders and planners need to consider too: What of the future? Will financial difficulties force institutions to lease parts of the buildings to franchisers, or to various sports company sponsorships? Is intercollegiate athletics about to experience some cost-cutting restructuring? Should colleges continue to make wellness, the inculcation of healthy lifestyle habits, and the development of physical energy to carry out important intellectual and artistic work an integral part of their educational program?

Whatever the future holds, the student recreation center has become a new kind of building for new kinds of activities on campus in the past 15 years. Campus planners who have not already done so will need to take note of this latest addition to American university architecture. ■

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A different kind of educational bookstore is being created within colleges and universities.

The New College Bookstore

John Finefrock

Editor's Note: This article has been edited by the author especially for this volume and includes a postscript.

What is difficult for most people, not only booksellers, is to acknowledge responsibility for creating a better future. In the distraction of daily details, caught in the web of existing practices, and seduced by old habits and the latest fads, we fail to undertake strategic changes that can remake our lives, our professions, and our institutions so that they contribute to a fresh and finer future, especially for the young.

But some bookstore managers at American colleges and universities have begun to transform the campus bookstore into a every different kind of place, a new kind of college center. They think this strategic change will contribute significantly to the intensity of intellectual life on campus.

The traditional college bookstore mostly provides items directly necessary for college work: notebooks, pens, textbooks, basic art supplies, and college memorabilia (pennants, mugs, T-shirts, and the like). It is usually cramped, strictly functional, uninviting, and open only during normal business hours. Some of these store managers don't even like books but see them as "merchandise." And most colleges treat their bookstore managers as clerks; campus bookstore managers are among the lowest paid professionals at academic institutions.

The managers of the "new" college bookstore, however, (and I include myself among them) are trying to create a radically new kind of gathering place on campus. Frankly, we are dreamers who are using our practical skills to build a dream in the heart of academe. This may sound grand, but some of us believe that the search for and accumulation of good books

John Finefrock is manager of the bookstore at Kenyon College in Gambier, Ohio, where he also teaches Chinese. He earned a B.A. from the University of California, Santa Barbara and a M.Div. from the Graduate Theological Union in Berkeley. Before coming to Kenyon in 1982, he managed the Chautauqua Bookstore in upstate New York and was head of publications there. The Kenyon College Book Shop has been called "best U.S. college bookstore" in Lisa Birnbach's *College Book* and in *Rolling Stone* magazine, and has been cited by *Publisher's Weekly* as having "the highest sales per student in the USA."

Featured in *The Wall Street Journal* in 1992, Mr. Finefrock won the 1995 Kenyon Faculty Cup for Distinguished Teaching, was a John S. Knight Fellow in 1995-96, and is also the author of *The Future of the Campus Store*, 1993. He has a nationwide book store consulting practice. "The New College Book Store" is often cited in requests for bids on new college and university book stores and student unions.

by students can be like the quest for one's soul or the meaning of life. We are trying to build a physical facility appropriate for young people's hungry search for culture, self-identity, and intellectual acumen.

Most colleges treat their bookstore managers like clerks.

The college store business

According to the National Association of College Stores, there are 4,500 member stores in the U.S. and Canada. They grossed about $8 billion in 1992. Books and texts account for 60 percent of sales, but in the past decade non-book items have been increasing—food, clothing, candy, backpacks, posters, hair dryers, computers—because the profits are higher in such merchandise. As a result, many college stores now resemble crowded convenience stores, and in some of them books have become a minor part of their activity, relegated to a back section because the number of items in the store has increased but the space of the store has not.

The search for good books by students can be like the quest for one's soul.

Not so at the Seminary Students Coop in Hyde Park, Illinois, which has a splendid stock of books. Or at the Hungry Mind, the attractive bookstore for Macalester College in St. Paul, Minnesota, with its great spaces and lofty ceiling. Or at the bookstores of Dartmouth College, Kentucky's Centre College, the University of Toronto, or the University of Washington in Seattle. Or at the magnificent University of Iceland bookstore in Reykjavik. These, and others like them, are college stores where books are central, the spaces handsome, and where students and fac-

The trade book section of the University of Toronto Book Store in the great reading room of the former Metro Toronto Central Library. The Bookstore is the third largest bookseller in Canada with more than 50,000 book titles in stock and more than 300 magazine titles.

ulty hang out as if the bookstore were an intellectual community center.

These new bookstores are places where university presidents and planners have insisted on a facility that looks and feels good, that invites with visible cues all the campus constituencies to the great party of life in which learning together is the most fun of all. A visit to buy the *Washington Post*, the *American Scholar*, or a new book on 20th-century music leads a student past a display of the best new academic books, into a meeting with his or her philosophy professor, near an admissions officer with parents and prospective student in tow, and past members of the soccer team reading magazines while they wait to get picked up by a bus for their next game. These new bookstores have poetry readings, autograph signings, jazz concerts, and comfortable chairs in which to read. They are gossip-central, the major meeting place for students and faculty to meet informally. Alumni, local citizens, tourists, and students from other colleges come long distances to spend a day at these stores.

The new college bookstore is usually the result of a daring president, a demanding faculty, and a creative, bookish store manager coming together. That is how our

The Kenyon Book Shop is open 365 days a year.

bookstore at Kenyon College began. The Kenyon professors were unhappy about their college store, which was the only place to buy books in Gambier, Ohio (pop. 2,100), and a faculty committee drew up an idealistic wish list for an enlarged exemplary bookstore. The president endorsed their report. To the amazement of the faculty, I took their report seriously and a decade ago begun to build their ideal store. We expanded into a former pizza restaurant next to the college, renovated the basement for sales space, and built an addition to the building so that Kenyon now has a 15,000-square-feet store.

A most unusual place

The Kenyon College Book Shop is open from 7:30 a.m. to 11:00 p.m., 365 days a year. The floor is carpeted and the 14-foot high walls are covered from floor to ceiling with oak shelves of books. In the rear of the store we have a living-room-like reading area with sofas and upholstered chairs, and large windows that look out into a green, wooded area. There is piped-in classical music, and kites hanging from the ceiling. (Above the cash register, a local artist quilted a replica of Michelangelo's Sistine Chapel ceiling to hang from our ceiling.) We used to have flowers and plants all around, but that became too expensive.

You can get coffee, bagels, ice cream, and rootbeer.

The Kenyon College store stocks about 80,000 book titles a year. With certain publishing houses like Oxford University Press or Harvard University Press we buy a copy of every book they publish, and we have them on our shelves months before the reviews come out. (Our librarians thus can inspect new books before they buy them.) You can find an extraordinary range of just-published books in our store, from medieval medicine to the latest poetry of Maya Angelou. We keep new books for one year or two, then return most of them to the publishers if they don't sell, so we seldom compete with our college library.

We also stock about 500 magazines and scholarly journals, from Rolling Stone to Vogue, covering computers, tennis, foreign affairs, religion, and African arts and culture (*Callaloo*). These are very popular with students and faculty, who often read an article, walk to one of our photocopy machines to make a copy, then replace the magazine. (As with books, most magazine publishers accept returns, so we feel we can stock as many as we have space for.) The texts for courses are in a separate section.

There is an area where you can get coffee, bagels, Ben and Jerry's ice cream, and

10 varieties of root beer. You can have breakfast and lunch in the store and spend all day till nearly midnight browsing and reading in an armchair without buying a thing. No one is pressured to buy; but curiously the more we let people explore and read, the more they buy. The Kenyon store sales have quadrupled in the past 10 years. Our staff consists of 22 full-time and four part-time trained professionals. We use no student clerks.

There is a conference room, and we hold classes in the store. There is a huge brag board with newspaper clippings about our students, Kenyon's teams, and faculty book reviews and articles. We have poetry readings, small concerts, and displays of the best student art.

The Kenyon College Book Shop also tries to provide for all the daily needs of students, faculty and staff. So we sell music tapes and CD's, basic hardware and furniture, cards, art supplies, stationary, aspirin, printer ribbons—really a bazaar of student and faculty needs. We also try to provide surprises so that people keep coming in. The store once sold live baby rabbits and fuzzy, yellow baby chicks for Easter; but the creatures chewed on electrical wires, created safety and health problems, and the administration and maintenance staff told us, "Never again." When we opened a camping section, we brought in six-foot stuffed bears to sleep in our pup tents, complete with jars of honey, canoe paddles, and magazines that bears might read. Little did we imagine that faculty children would crawl into the tents and use the large bears as couches while they read their children's books. Our store gets cluttered from time to time, but our view is that where there is occasional mess there is life. The students love it.

We are inventing an on-campus intellectual community center.

The Kenyon store does a considerable mail-order business. We order all the books for the college library. We even order books for the University of Tokyo! (They heard of us, and our book prices are cheaper than those in Tokyo). We also help faculty with out-of-print book searches, and have a service desk to answer any student questions about books or journals. Surprisingly, the Kenyon bookshop has no security guards, and has almost no pilferage, or "shrinkage" as store managers call it. Studies have found that one in eight store visitors steal, especially in urban areas; but we have so far not had a problem.

The Kenyon Book Shop has elements of a library, newsstand, student center, Viennese cafe, and convenience store but has mixed the elements. We believe Kenyon—and other institutions like us—are inventing a novel kind of place, an on-campus intellectual community center. Students write their class papers in our chairs and play chess. A few faculty and students have written novels in our bookstore.

Does it make money? Properly run, these new college bookstores can and should earn a small profit, as the Kenyon store does. In fiscal year 1995-96 we had revenues of $2.4 million (excluding computer sales)—in a tiny Ohio town of 2,100 people. One hundred percent of our net profit—about four percent of total gross sales—goes to the college's student scholarship fund, which we think is proper but which also helps sales because students know they get back some of the money they spend.

But the real "profit" comes in other forms. The Kenyon College Book Shop is used by the admissions office to attract the best students; and at least a few recruited faculty have chosen Kenyon because they have the same access to new books, journals, and magazines in Gambier, Ohio as they would in Cambridge, New York, or San Francisco. A store like Kenyon's says to visitors, "This is a college where learning is taken seriously." Our bookstore makes a statement about Kenyon College. It differentiates us.

Perhaps the largest profit is the sheer pleasure of large open spaces, warm in win-

ter and cool in summer, where one can read, explore, talk, eat, relax, and listen to the world's best music and informal little concerts, where sophomores can literally bump into their professors, discover new journals and ideas, savor the latest clothing fashions, poetry, and tips on bicycles, and buy delicious new chocolates from Switzerland.

What are the ingredients?

This new kind of college bookstore has several features I think are imperative.

Space. Space is the key element. Most university stores are only one third or one

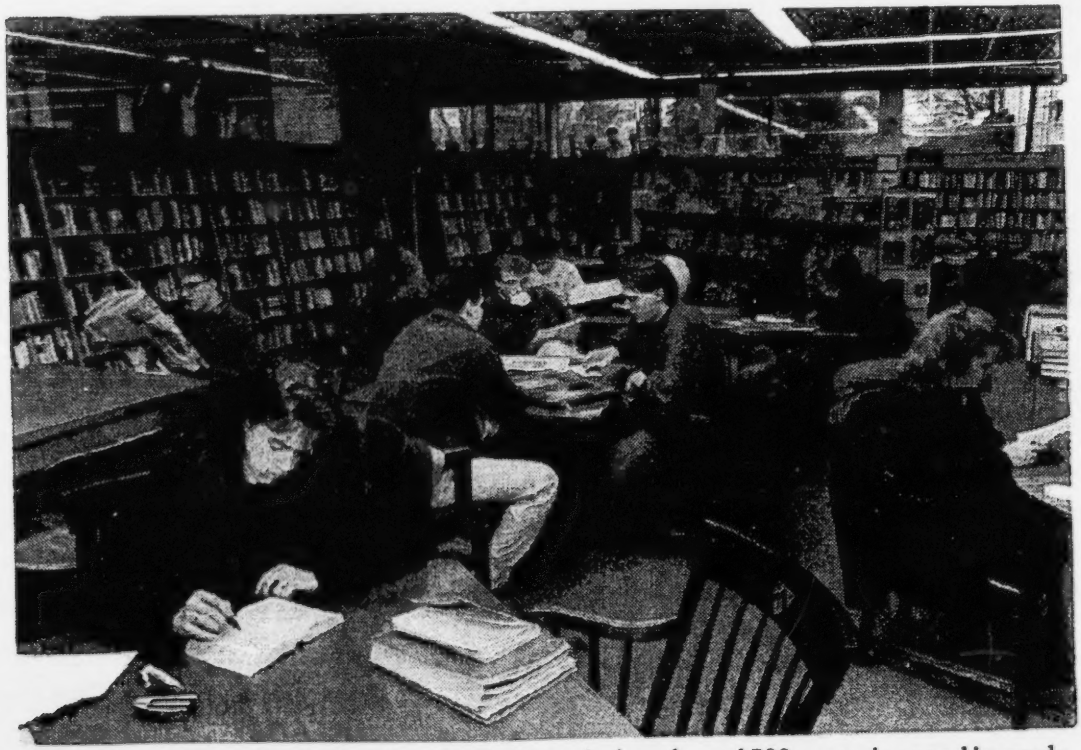
Space is the key element.

half the size they should be. You need more room for tables, chairs, and sofas, and aisles that are wide enough. The ceilings should have height too. The most stunning, inspiring bookstore I have ever seen is in Helsinki, Finland. It was designed by the noted architect Alvar Aalto and has a very high curved ceiling, giving the shop a cathedral-like grandeur.

The walls should be lined with books; that creates a lovely ambiance, as it did in J.P. Morgan's magnificent library. You'll need to provide chairs and tables for 100 to 200 students, racks for 500-600 magazine and journals, as well as a dining area where students, faculty, and staff can have coffee, a soft drink, and a gourmet snack.

Long hours. One reason many people don't visit bookstores is because they are usually closed. Colleges need to find a way to have their community center-bookstores open earlier each day and later each night, seven days a week. Bookstores should have hours like a cafe, not like a bank.

Quickness. Colleges can get Sunday book reviews from leading newspapers on Friday. There's no reason to wait for the reviews before buying new books. Ideas should be handled like hot news, not like yesterday's beer. Students and faculty appreciate a college store that helps them stay at



The Kenyon College Bookshop has classical music, bagels, and 500 magazines and journals, and stays open 365 days a year.

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the forefront, especially in non-popular fields. Professors get a jolt by discovering new stuff they didn't know was published yet.

Provision for daily needs. The best new stores on campus are really attuned to supplying student and faculty needs: a well-

The best new campus stores bristle with life and activity.

brewed cup of coffee, the best cheap pens, computer discs, comfortable jogging shoes. Know your students and professors and what they require in their daily intellectual work and their best leisure.

Intimacy with the college. It is surprising how little most campus book shops relate to the special activities of their institutions. Often the local taverns feature photographs of the sports stars from the college teams, and local restaurants list the coming lectures, concerts, and dramatic shows on campus more than the campus bookstore does. Faculty books, articles, and photographs, and student accomplishments and productions should be prominently displayed, and bulletin boards should pin up references to the college, to alumni, to trustees, and community leaders.

Life. The best new campus stores bristle with life and activity. Students especially are a boisterous, irreverent, athletic group. They are different from other adult commercial shoppers. The campus bookstores of the future will reflect that energy, as well as young people's quieter quests for learning and love, friendships, and a philosophy or religion to live by. ■

POSTSCRIPT

John Finefrock has updated the information contained in this 1993 article to reflect more recent data. In addition, he offers the following postscript:

A trend toward leasing?

There appears to be a growing trend toward leasing out bookstore space and associated operations. In 1990, according to the National Association of College Stores, 655 college bookstores were managed by lease companies. By 1996, the number of leased stores grew to 1,065, or about twenty-five percent of U.S. college bookstores. Institutional stores represent half of all college stores, while private stores represent fifteen to twenty percent of the total, and cooperatives make up roughly five percent.

Among the recently leased bookstores are those at Harvard, Yale, and the University of Chicago. The University of California at Berkeley is taking this option under consideration. Meanwhile, Columbia University has retained its lease operator for textbooks and supplies, while simultaneously providing space in a new building for a privately-owned academic bookstore. Columbia promotes the private bookstore on its web site.

There are a number of reasons for this apparent trend. College stores, which have existed in some cases for a hundred or more years, are facing increased competition from the burgeoning ranks of the superstores. In many instances the profitability of college stores, usually marginal to begin with, has dwindled significantly.

Even when financial officers are not demanding high rent or high return from an institution's investment, they are less and less willing to support a bookstore's annual losses. Leasing is seen as a way to bail out a faltering operation while increasing income to an institution. It is also a way to continue offering bookstore services to the campus community, often in space that has been newly renovated and decorated at the lessor's expense.

Will bookstores cease to exist?

Does the apparent trend toward leasing bookstore space and operations presage the future on college campuses? The shift toward leasing may also ultimately affect libraries and computer centers, particularly if lease operators can offer students more services at a lower price than traditional institutional libraries and information services.

Why, some might argue, is a physical location or building even required for a bookstore? Such may be the case as colleges engage in distance learning and explore alternatives for delivering commodities currently provided by bookstores. Yet, bookstores are potentially very different from each other, grounded in distinct institutional identities and providing privileged commodities such as books along with generally available items such as sweatshirts, pens, and mugs. If these campus-run bookstores are homogenized into a superstore or another centrally commercialized entity, much would be lost.

BOOK REVIEW

Residence Halls as a Place to Learn

Realizing the Educational Potential of Residence Halls, by Charles Schroeder and Phyllis Mable. Jossey Bass, 1994. 319 pages. ISBN 0-7879-0018-4.

Reviewed by Carmen Guevara Neuberger

In the 19th century colleges had to provide housing for students because the colleges were usually built outside of cities, because most students were young teenagers in need of guidance, and because of the difficulty of travel. Then, college leaders often had educative goals for the student houses. Discipline in the dorms, harsh by modern standards, aimed at developing students' "character" and instilling good values. In a fashion that usually combined the spiritual and the secular, residentially-based institutions sought to educate the "whole person."

The goal of developing the whole person is still alive, and may be returning in a new form. As Charles Schroeder, vice chancellor for student affairs at the University of Missouri, Columbia, and Phyllis Mable, vice president for student affairs at Longwood College in Virginia, write in their new book, *Realizing the Educational Potential of Residence Halls,*

> Historically the student affairs profession has shifted its emphasis from controlling students to serving students, to the current emphasis on student development....By developing a philosophy of student learning, residence hall staff can use student development theory and process models as a means to facilitate student learning.

With great earnestness, this book insists that "residence halls must become purposeful and intentional educational environments." And Schroeder and Mable, both of whom were directors of student housing in their earlier years, have rounded up a dozen student affairs experts and scholars to contribute chapters that advocate their cause. It is a formidable array of experience, knowledge, and skill.

Schroeder and Mable address the book mainly to student affairs professionals and to provosts, deans, and department chairs who want to improve undergraduate learning but who "often overlook the role of the residence halls." The 13 chapters are acceptably written and organized into three parts: history and practices, innovative approaches, and educational impact. All the writers seem well aware of the powerful influences exerted upon individual students from close and constant association with their under-

Carmen Guevara Neuberger is president of Tuition Exchange, Inc., a national scholarship exchange service, based in Washington, D.C. She graduated from the University of Maryland, earned her Ed.D. from American University, and a law degree from the Washington College of Law. She has been a dean of students at both American University and Dickinson College. Last year she received the Esther Lloyd-Jones Distinguished Service Award from the National Association for Women in Education.

graduate peers. Each chapter has a strong bibliography behind its paragraphs.

All the contributors agree that those responsible for an institution's academic affairs must be involved in the discussion of plans and programs in the residence halls. They do not, however, include others who might make a contribution, such as admissions officers, officers responsible for the finances of the dorms, and representative bodies of parents. But in the end, it is the faculty and the students that are the crucial dyad on which better learning is built.

The authors provide a wealth of suggestions. John Welty, for instance, paints a picture of "the residence hall of the future." Arthur Levine recommends "guerrilla" tactics such as arranging the spaces in the halls more cleverly, taking advantage of teachable moments, and recognizing exemplary behaviors in some prominent way. His essay is surprisingly the only one that hints at the hedonistic culture of much contemporary dormitory life, as Moffat described in his 1989 book *Coming of Age in New Jersey: College and American Culture*.

Elizabeth Whitt and Elizabeth Nuss provide excellent examples of residence programs that are trying to integrate curricular offerings, such as those at Earlham College and Stanford, and they describe the Lyman Briggs School at Michigan State, a residential program for students interested in science as a career, and the University of Maryland's Honors Living/Learning Center. This is an especially rich chapter for details on apparently fruitful experiments.

Another chapter that planners may find helpful is that of Terry Smith, who believes that "residential colleges are having a renaissance." Smith's chapter is valuable too because, unlike the others, his addresses some of the considerable obstacles to education in the residential halls. Among the numerous barriers Smith notes: "Residential colleges are not cheap," and "Faculty tend to see residential colleges as 'housing stuff'" and not really part of their business. Most of the other chapters scarcely mention the faculty's current preoccupations and their reticence to assist in residence hall learning. Who is to do all this new teaching in the dorms, and how and why, is largely missing from this book.

One question I find to be urgent but unanswered by the book is that caused by the

Residence hall at Earlham College in Indiana, where students learn as well as reside.

growing popularity of interest-centered housing, whether multicultural, the arts, a foreign language, African American, community action work, foreign students, or some academic major. Do such clusters enhance or hinder the aims of a broad, liberal education and student development? I also would have enjoyed reading more content of a hands-on nature about how colleges and universities can actually introduce innovative learning programs for the two million American students who live in campus dormitories. The book is rich in invocations and urgings that residential life and classroom learning be brought closer together. More details on how this might be done, who should do it, and how it would be financed would have made the book more valuable.

Along with similar recent books such as Faith Gabelnick et al.'s *Learning Communities: Creating Connections Among Students, Faculty, and Disciplines* (1990), George Kuh et al.'s *Involving Colleges: Successful Approaches to Fostering Student Learning and Development Outside the Classroom* (1991), R. B. Winston et al.'s *Student Housing and Residential Life: A Handbook for Professionals* (1993), and Bloland, Stamatakos, and Rogers' provocative, new *Reform in Student Affairs: A Critique of Student Development* (1994), the Schroeder and Mable book presents a forceful case for higher education leaders to consider. Youth culture needs to be brought closer to the culture of serious learning and professional skills if U.S. higher education is to improve its quality.■

BOOK REVIEW

Gender Equity in Athletics: What Does the Law Require?

A Practical Guide to Title IX: Law, Principles, and Practices, by Walter Connolly, Jr. National Association of College and University Attorneys, 1995. 499 pages. (No ISBN.)

Reviewed by Marsha Moss

Institutions of higher education are struggling with the challenges of achieving gender equity in intercollegiate athletics at a time when financial resources are constrained and when many athletic programs across the country are experiencing operating deficits. How can institutions develop plans to provide equal opportunities for women in athletics which will meet the requirements of Title IX, be defensible against lawsuits brought by individuals or the federal government, and preserve their intercollegiate athletics programs?

This compendium, assembled by Walter Connolly, Jr., an attorney who specializes in the practice of labor, equal employment opportunity, and Title IX litigation, provides some answers to these complex questions.

Designed primarily for attorneys and Title IX compliance officers, a majority of the articles give detailed attention to the legislative history and case law relating to Title IX. Two articles focus entirely on defending against Title IX lawsuits: one from the standpoint of providing equal opportunities to participate in sports, and the other on athletic coach assignment and compensation claims. These technical though readable chapters allow administrators and planners to grasp the complexity of the issues surrounding this 1972 law.

The principle chapter in this compendium is written by Walter Connolly, Jr. and his associate, Jeffrey Adelman, and is titled, "A University's Defense to a Title IX Gender Equity in Athletics Lawsuit: Congress Never Intended Gender Equity Based on Student Body Ratios." It gives an excellent overview of the provisions of Title IX and how they are being applied by the courts, and offers suggestions to institutions regarding compliance and defense against audits and lawsuits. This chapter, like much of *A Practical Guide to Title IX*, presents information that campus officials will find revealing and contrary to some impression about the law's requirements.

So what are the requirements? Title IX of the Education Amendments of 1972 stipulates that "[no] person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." A 1974 amend-

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ment requires the Secretary of Health, Education, and Welfare to prepare regulations to implement Title IX "relating to the prohibition of sex discrimination in federally assisted education programs, which shall include with respect to interscholastic athletic activities reasonable provisions considering the nature of particular sports."

If federal funds are received by any part of an institution, including individual students receiving federally funded student financial aid, then the entire institution is subject to Title IX regulations. These regulations were developed and are enforced by the Office of Civil Rights Compliance (OCR). According to Connolly, institutions are in compliance with OCR regulations if they: "(1) provide athletic positions to men and women in proportion to their enrollments, or (2) demonstrate a historical and continuing practice of increasing athletic opportunities for women, or (3) are fully and effectively accommodating the interests and abilities of both sexes."

While the courts have only recognized the first provision as satisfying OCR requirements, Connolly contends that institutions should continue to promote the other two conditions as they create their plans and defend against challenges. He argues that measures such as high school and intramural sports participation rates are more appropriate measures of women's and men's athletic interests and ability than undergraduate enrollment rates.

OCR regulations further stipulate that athletic scholarships must be awarded to men and women in proportion to their participation rates in intercollegiate athletics, that discrimination based on gender is prohibited in all athletic programs, and that equal opportunities to participate in sports must be afforded to men and women. A list of ten factors—from travel budgets and housing to practice conditions—is examined in the determination of equal opportunity to participate. Connolly presents an in-depth legal analysis of all of these compliance issues and points out the flaws in some of the courts' interpretations of these regulations to date.

Connolly effectively presents the negatives surrounding the implementation and interpretation of Title IX regulations. He devotes less attention to the positive aspects of these requirements. One article, however, written by Donna Lopiano, president of the Women's Sports Foundation, highlights the health benefits for girls and women who participate in sports and tries to dispel the notion that the gains in women's athletic opportunities have resulted in diminished opportunities for men, particularly in football. Lopiano also offers a list of measures that can be taken to cut costs and increase revenues in order to fund additional sports opportunities for women which will not adversely affect participation rates for men.

Connolly's final contribution to this guide is a valuable set of questions and tables that institutions can use as a self-study document to identify, by sport and by athletic program, any areas in which gender inequities may exist. This in-house audit of athletic programs should be highly useful to institutions worrying about Title IX litigation or an OCR audit.

For anyone who has administrative responsibility for athletic programs, budgets, Title IX compliance, or for facilities, this compendium provides an excellent and detailed analysis of the gender equity in athletics requirements. If you do not, consider yourself lucky. ■

V. Outdoor Spaces

New forces are ruining many college landscapes. A novel planning activity can help halt the erosion.

The Neglected Campus Landscape

Michel Van Yahres and Syd Knight

Look carefully at the photographs used in the admissions viewbook to help sell your college to prospects. Whether you are a small college, large state university, or a prestigious institution, it is a sure bet that the prospects will see pictures of impressive architecture in a park-like setting. There will be shots of the campus fountain (if there is one) and students studying or socializing on green lawns or under the leafy canopies of mature trees.

It's a simple fact: young people and their parents respond to such images. After all, it is "home" to the undergraduate for four or more years. When high school seniors were recently asked how they chose their college, a surprising 62 percent said it was mainly by "the appearance of the buildings and grounds" (Boyer 1987, p. 17). The first impression of a campus can have a powerful effect.

But while admissions officers and some devoted alumni appreciate the importance of the campus landscape, most persons at a college or university rarely perceive landscape design as worthy of the care and attention paid to other aspects of the institution. The campus landscape is often the neglected realm. Even experienced campus planners tend to worry more about interior spaces and architecture.

But a college or university campus is more than just the buildings and their rooms. It is also the rational organization of outdoor spaces and all they include: pavements, walls, lawns, trees, fences, shrubs, ponds or streams, signs, outdoor furniture, lighting, waste disposal containers, utilities, parking areas, and outdoor art. The campus landscape is the fabric that holds the buildings together. (The word "campus" comes from the Latin word for a field.) It's the first thing people see when they enter a school, and it's the image they carry in their minds when they leave. It's where students and faculty often mingle and new friendships are formed. At its best the campus land-

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scape can be a serene and sensual experience. It should not be neglected.

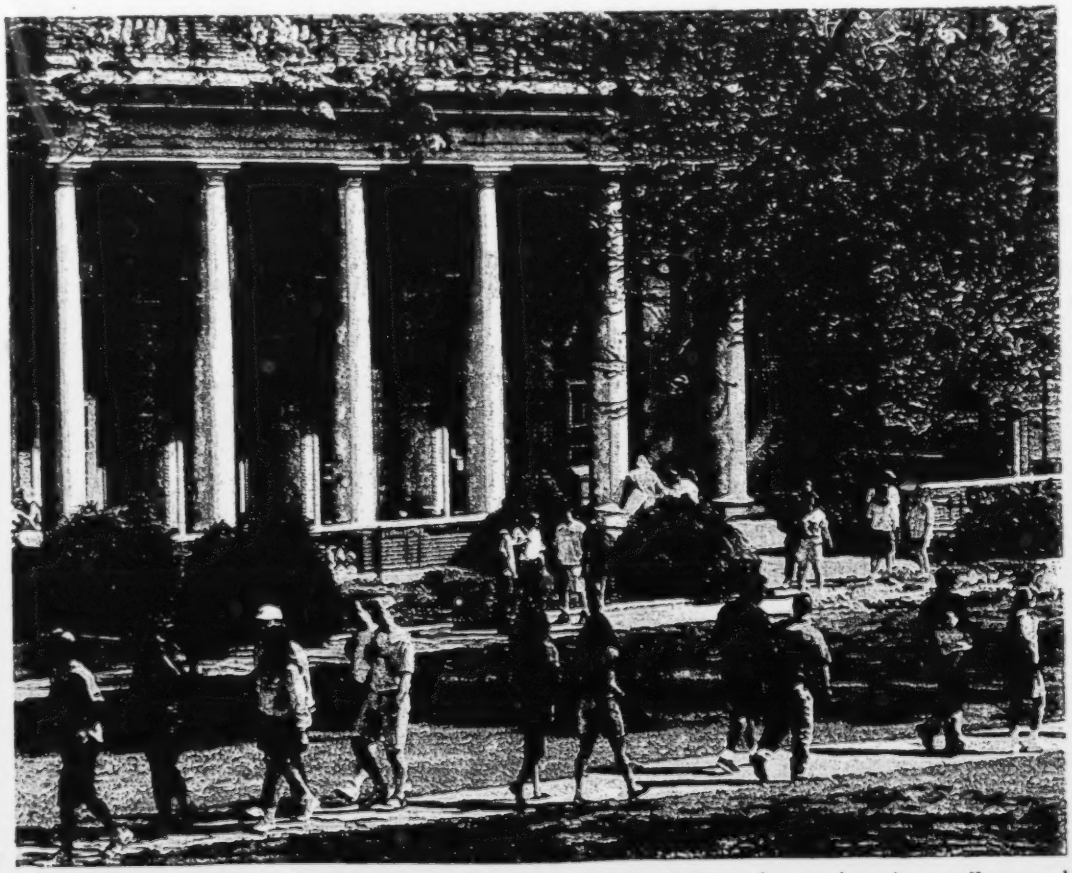
It's no one's responsibility

There are reasons for this neglect. Campus planners and resident architects usually concentrate on buildings, equipment, and the academic programs inside the buildings, where the students go to classes. Often the campus landscape is left to the groundskeepers, some of whom may be trained in horticulture but most of whom are not. Master plans usually focus on site planning for buildings, and frequently neglect the impact of these buildings on the outdoor spaces. Faculty members tend to see money spent on the campus grounds as a frivolous expenditure that would be better spent on their own salaries or on library and computer purchases. And the voracious demands for more parking space frequently prompt universities to pave ever larger sections of the greensward.

In their attempts to accommodate these conditions, attitudes and trends, many institutions have created some new campus problems. Here are a few.

The first impression of a campus can have a powerful effect.

Inappropriate development model. In the absence of a clear understanding of campus design concepts, some colleges and universities have adopted a model for their landscape that is becoming the norm elsewhere: that of suburban commercial development. A growing number of institutions are abandoning the long-established



An attractive, park-like setting is a distinctive feature of the design of most American college and university campuses.

practice of primarily using mowed lawns and large trees in open unpaved areas, with shrubs reserved for important spaces and purposes. Now, regardless of location and relative importance, buildings are more and more often surrounded by seas of flowering shrubs, bulbs, and annuals in an attempt at horticultural display. The result is that newer campus plantings look like those around large suburban homes or shopping malls rather than traditional college campuses. This new-model campus horticulture erodes the spatial hierarchy that is so crucial to campus legibility and function.

Faculty members tend to see money spent on campus grounds as a frivolous expenditure.

Transgressions of the organization of spaces. Appropriately designed campuses have a well-ordered sequence of spaces, each possessing a special character which defines its importance in relation to the rest of the campus. And most of the finest campuses have a definable center—such as the famous lawn at the University of Virginia—a place where, if someone says to meet him or her "at the center of the campus," no further explanation is necessary. But development recently has eroded this spatial clarity through construction of new mega-buildings, or by piecemeal building-by-building growth, or by small parking lots placed near buildings, violating the inner spaces. In some cases, the campus no longer has a center, or, as at very large universities, several centers—for the undergraduate, graduate, medical, and business school complexes.

Confusing circulation. A byproduct of the loss of spatial clarity is that circulation is confusing to visitors, especially prospective students and their parents. As more institutions try to satisfy the demands of various campus constituencies for easy access, they have built a hodge-podge of internal paths, roads, and parking areas. And good signage is frequently missing (Brown 1992-93). This can have negative consequences. Many prospective students and their families apply a "moment of truth" test, asking themselves, "Is this a college where I will feel comfortable, where I would like to spend the next four years?" Institutions which do not have a clearly defined entrance, a campus map, obvious roads to important destinations such as the admissions office and the campus center, may have lost an opportunity to create favorable first impressions.

Inconsistent use of materials and details. Without a campus landscape plan and driven by the pressure to try new materials with lower purchase and installation costs, campuses are increasingly ignoring long-term benefits, life-cycle costs, and aesthetics. The result is often a mish-mash of elements and materials (wood, concrete, light metal, etc.). The outdoor appointments—walkways, light fixtures, horticulture, benches, trash receptacles, signs, bollards, and more—should have the same consistency of design and materials as the buildings on campus.

Hard-to-maintain plantings. Institutions are now planting trees of the shorter-lived varieties—Bradford pear trees, flowering crabapples, and the like—that are often handsome flowering specimens but are poor long-term investments. Over 75 percent of the trees planted on campus today have a life expectancy of less than 30 years (see Figure 1). What's more, these trees have far higher maintenance needs than do long-lived species. The new emphasis on shrubs, flower beds, and unusual ground covers also requires greater amounts of labor, fertilizers, pruning, watering, and attention.

Utilitarian parking spaces. To satisfy demands for in-close parking, many schools are simply paving over campus open space. Instead of considering parking spaces as part of the campus landscape and subject to the same values and standards, colleges tend to view parking areas as a separate, unrelated issue. Campus parking is essential; but it should complement the visual character of the campus, not violate that character.

What's the corrective?

We think the most effective way of halting the erosion of the campus landscape and its rising maintenance costs is a two-part planning effort. One is a new procedure we have developed called the campus landscape assessment. The other is the more familiar campus master plan, but one that employs the same good thinking about outdoor spaces as it does to the location of new buildings.

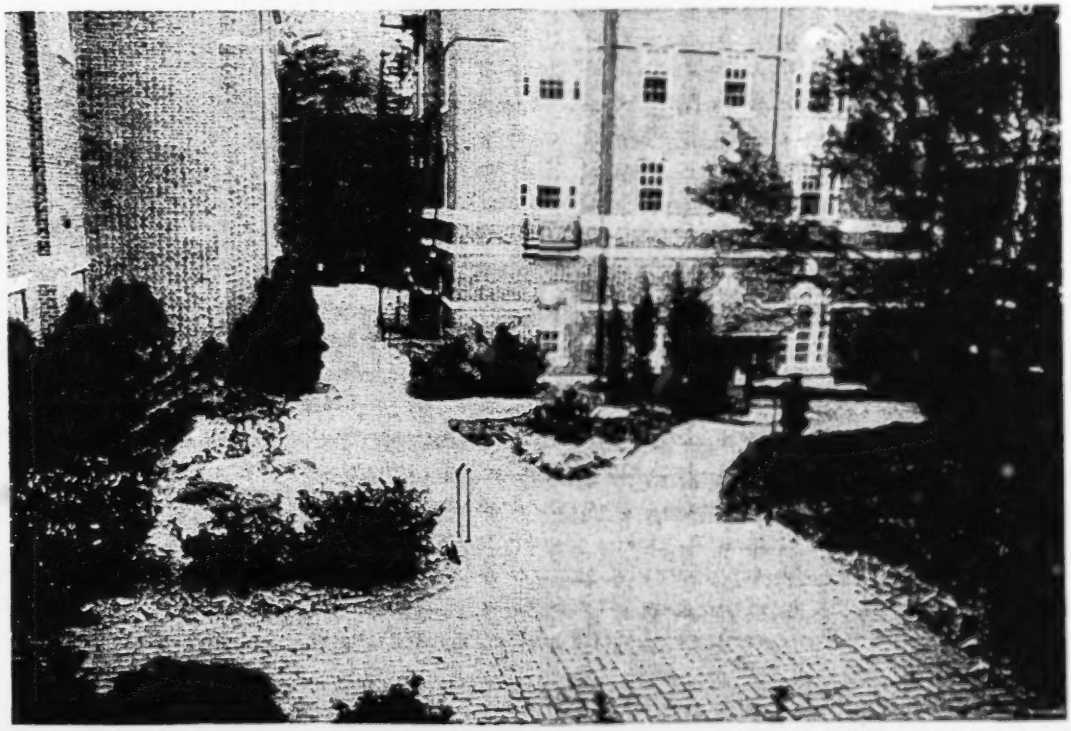
The campus landscape assessment is simplicity itself. A small team of expert landscape architects who appreciate the special character and needs of college and university campuses assesses the present character, condition, and maintenance schedules of an institution with an eye to three concerns: the character and educational aims of the college; the appropriateness, beauty, and function of the landscape and its plantings; and the costs of its upkeep. (The landscape assessors usually work closely with the campus architect or facilities director and the director of grounds maintenance, or at a small college with the president or board of trustees.)

The campus landscape assessment evaluates what is being done right and shows how to build on these strengths, and offers an action plan to correct those practices that are inappropriate for the university and its traditions, for the regional arboriculture and horticulture, and the overall campus design. It also suggests how the school can reduce its

Newer campus plantings look like those around large suburban homes.

expenditures on the grounds upkeep. In most assessments, the appraisal, which usually costs from $10,000 to $40,000 (depending on campus size and complexity), pays for itself in a few years by reducing management and maintenance costs, as well as by preventing costly mistakes.

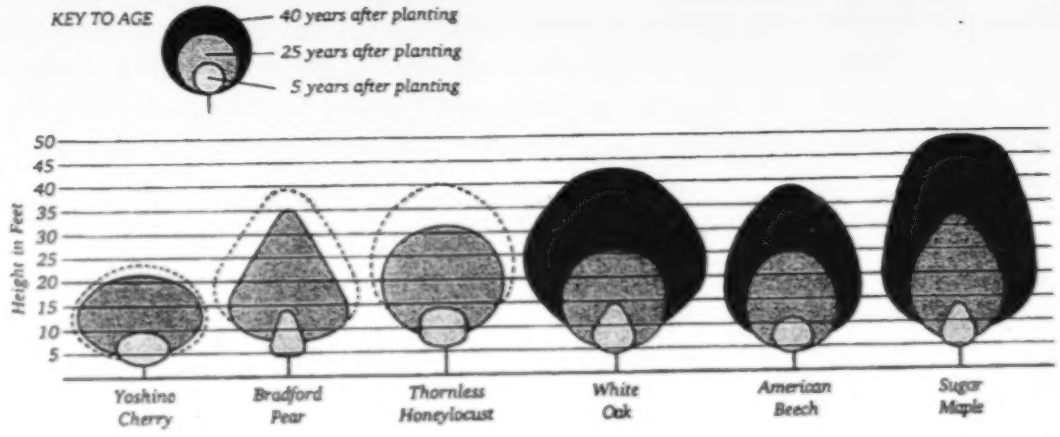
For example, at a small, rural college in the southeastern United States the architects had proposed in their master plan six



An example of poorly done new landscaping. Secondary spaces are overembellished, and dozens of plant specimens are used, increasing maintenance costs as well.

FIGURE 1

Average Life Expectancy of Campus Trees



new buildings and renovations, each with elaborate student plazas. In the campus assessment that followed the master plan submission, the assessors noted that the campus gained its strength from its system of lovely paths in a rural setting. The landscape assessors pointed out that the proposed outdoor, paved plazas would contradict the college's chief physical asset—its rural character—and might not be used by the students and faculty. The plazas would also cost an extra million dollars or so, add to the college's maintenance budget, and probably require an additional employee for upkeep.

At Virginia's James Madison University the task of the campus landscape assessment was to "showcase" the campus better while at the same time reducing the work force for the grounds. The assessors observed that the university campus was composed of precincts, as defined by exposure to the public and by use of the students and staff. The assessment proposed that each precinct have customized design and maintenance standards according to its relative importance. So the main quadrangle would no longer aspire to continuous floral exuberance which required labor-intensive upkeep, but would be restored to a grand lawn with formal hedges to reinforce the walkways and complement the historic buildings. And the main road into the campus would become a canopied avenue parkway, with the current plantings replaced with tall, long-lived trees, again requiring less maintenance.

The campus landscape assessment is a different animal from a campus master plan. While the master plan guides future capital development with an emphasis on sites for future buildings, the landscape assessment focuses on the college's current landscape and its design, circulation, planting, and maintenance practices. We believe the landscape assessment should precede or go along with the master plan creation (Biehle 1991).

How does it work?

The campus landscape assessment usually takes two to four months, but can take six months or more for a major university. We think the process works best if it follows some steps we have found successful.

1. *Analysis and inventory.* The campus landscape assessment should begin with a brief analysis of the college's history and the factors that have affected its growth, and of the special qualities, traditions, architectural design, and educational emphases of the institution. Interviews with institution leaders and

representatives of key constituencies are helpful to determine the principal values and most important goals of the college or university.

Then the assessors should evaluate the elements that make up the outdoor campus: lawns, pavements and roads, fences, irrigation, trees, outdoor furniture, and the like. Do they enhance the historic traditions and current goals of the institution? Are they appropriate for the kind of higher education offered, for the student clientele, for the buildings on campus? How well organized are the spaces?

2. *Arboriculture and horticulture appraisal.* Trees play a central role in campus landscape design. The assessment should next examine the campus trees' condition, location, and species, yielding information that ensures the maximum survival of the existing trees and that helps decide on replacement or new trees. The same should be done with the shrubs, grasses, and ground covers. Are the plantings right for the topography, soil, climate, and harmony of physical appearance?
3. *Circulation appraisal.* The assessors should pay particular attention to the paths for pedestrian and vehicular movement—from jogging or bicycle trails to truck deliveries. Is the circulation clear and rational? Is the signage adequate? Do the parking areas intrude and disrupt, or do they fit into the landscape fairly well?

At Hampton-Sydney College's historic campus, the campus core had in the past half century been covered with a scattering of small parking lots to place parking close to each building. An assessment study found that most faculty, staff, and students parked their cars for the entire day, then walked or biked around campus. So the college created long-term parking lots on the campus periphery and restored the handsome campus core.

4. *Maintenance and management.* We find that maintenance of the existing landscape is often the most overlooked component in campus planning and design. The assessors should be certain to review the maintenance schedules, staff, equipment, and decisionmaking. Who directs and manages the landscaping of the campus, and how well is it being done? How much is spent, and how can maintenance costs be reduced?
5. *Guidelines and alternatives.* The landscape assessment should then develop some guidelines for the college's staff to follow, guidelines and standards that will best arrange spaces, circulation, and plantings, given the institution's mission, history, and strategic emphases. And the landscape architects should provide two or three alternatives the college can consider for maximally protecting and enhancing its appearance and functionality.

The campus landscape assessment is a different animal.

Each alternative should include the approximate costs in both dollars and staff/crew time.

6. *A preferred action plan.* To be fully responsible, the campus landscape assessors should suggest their preferred action plan. It should be concise, practical, and directive, with clear and specific priorities and recommendations, timetables, costs, and advice about who should be responsible for what. It will probably correct or compensate for landscaping inadequacies and faults, and should point to attractive new arrangements that will augment the school's educational programs and provide positive visual memories for the graduates.

We are of course prejudiced because we are landscape architects. But we believe a college or university should make *all* of its physical plant as functional, rational, and appealing as it can by integrating superior architecture and superior landscape design (Sensbach 1991). The American college campus is a unique development in world

architecture. As architectural historian Paul Venable Turner wrote (1985, p.6),

> To a remarkable degree, college planning in America has an independent history, evolving its own forms and producing its own innovations, less subject to European fashion than other fields of architecture and design...As a result, [the American campus] has been the laboratory for perhaps the most distinctively American experiments in architectural planning.

The campus landscape is an integral part of the design of these "distinctively American" academic enclaves. It is also a somewhat separate entity, worthy of the same careful design and preservation as the buildings within it. Indeed, campus landscape architecture might help furnish a model for design in the rest of society. In the words of *San Francisco Chronicle* architecture critic Allan Temko:

The American campus is a unique development in world architecture.

> It is on the campus, as virtually nowhere else in the country, that architectural permanence, rational organization of diverse activities, generous provision of open space and a liberal respect for the arts and sciences...can be seen acting together to provide an organic milieu for civilized life.... The campus, at its finest, embodies principles of design which may be fruitfully employed throughout our civilization (Temko 1993, p. 137). ■

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New developments are changing the face of campus grounds.

Approaches to Contemporary Campus Landscape Design

Carol Johnson

Much has been written about campus master planning, the arrangement of buildings on a campus. The fabric of the landscape on which the buildings are placed—the surfacing, site furniture, circulation routes, and vegetation—usually receives less attention. Yet in the final analysis, it is often the landscape fabric that makes a campus truly memorable. Particular campus features are frequently the first thing loyal alumni and alumnae mention when discussing their fondest memories of college.

If the Greek idea of the total person can be characterized as a sound mind in a sound body, then the modern idea of a total college or university might be said to be outstanding classes in an outstanding landscape. Every institution should create and maintain noteworthy campus areas, and employ a team that includes a landscape architect, the campus planner, administrative and maintenance staff, and faculty and student advisors. Each college can, and should, provide a unity of landscape treatment in the smallest paths, parking areas, and entry spaces to give its environment a sense of seamless order and harmony. Simple things like consistent lighting, pavements, signage, and edging clarify an institution's image and add delight for students and professors.

Also, the condition of its landscape should represent the college's devotion to stewardship of the land. Ill-kept, degraded areas for informal car parking or for dumps, and eroded paths send a message to the public about the values of the college leaders. Universities still represent ideal communities as few places do, and should be in the forefront of ecologically sensitive and sustainable management practices such as reuse of materials, planting for climate control, reuse of surface run-off, and erosion control. Universities should be sensitive to their neighborhoods too. Good landscape

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design can help handle lighting, screening, land use, and circulation problems, which sometimes anger nearby property owners.

However, putting good landscape design and maintenance into practice these days can result in dilemmas. For example, a university may develop an in-house nursery to grow trees, shrubs, and flowers for cheerful campus displays. But maintaining an in-house nursery may make the cost of trees more expensive than purchased trees from an outside nursery. Likewise, it is usually cheaper to buy chrysanthemums each fall than attempt to plant and maintain them permanently. It may be helpful to look at three central elements in campus landscape design: hard surface areas, site furniture (benches, lights, kiosks, security devices, signs, bicycle racks, trash receptacles, fences), and soft surface areas.

Universities still represent ideal communities.

Those hard surfaces

A key campus landscape ingredient is the balance between hard paved surfaces and soft, grassy surfaces. At urban universities, where soft areas are limited, the soft surfaces require special treatment for maximum impact. At rural campuses the balance is often affected largely by the requirements of daily usage, especially the need for paths.

The width and surface of pedestrian paths is an issue.

For example, the frequency of use of a path across campus may suggest that it be narrow. But in colder climates where snow clearing equipment is used, the paved area may need to be wider. Even in warmer climates, the increasing use of maintenance vehicles may require extra pavement. Maintenance vehicles also require turning radii or their tires will scar the lawns at the corners. The new practice of using golf carts, as many institutions now do, reduces this problem, but sometimes materials must be transported by a larger vehicle. I think it is desirable to pave these turning radii in a hard material different from the path, such as cobblestone, preserving the visual character of the path.

At one time stonedust was acceptable for little-used paths; it is inexpensive, slows water run-off, and can be plowed of snow. However, mechanical wheel chairs sometimes get the tiny pieces of stone caught in their motors, so most paths are now paved in hard surface materials.

The Americans with Disabilities Act of 1990 mandates ramps for all buildings, so this has become another hard surface concern. The legislation requires that ramps be three feet wide, sloped no more then one foot every 12 feet, with handrails. But if ramps have a slope of one foot every 20 feet, no handrails are necessary. Ramps without handrails are easier to maintain and look less cluttered, so installing the lower pitched ramps are preferable. Whatever the pitch, the exact connection of these ramps, especially to historic college buildings, poses a problem of enormous proportions. A ramp structure at grade, separate from the building but sympathetic with its materials and style is very difficult to design. The simplest, and most natural treatment may seem to be raising the grade around the building, but the bases on which the architectural character of the building is established may be covered. The best solution for this new hard surface is usually some compromise that provides new handicapped access, improves entry for the general public too, and preserves the architectural integrity to the greatest extant possible.

What kind of paving and edging materials are best for campus paths and drives? Characteristically, many universities have paved walkways in either Portland cement or bituminous concrete, except for special places. In northern climates, bituminous concrete surfaces have a tendency to heave, and tree roots break its surface easily. The alternative, cement concrete, is more expensive but more permanent, unless considerable salt for melting snow is

applied on it. Some campuses have concrete pavers or brick on their walkways, but budget constraints often limit their use.

Material	Cost per square foot
Bituminous Concrete	$1.50
Portland Cement	3.50
Concrete Pavers	10.00
Brick	12.00

Whatever the paving material, finding the desirable width of main campus walkways is a puzzling problem. No matter how wide the path in intensively used areas, a strip of worn grass or broken plants nearly always appears just outside the pavement edge. Widening paths further is not the solution. A low pedestrian curb at the edge of the walk does seem to help. Raising the soft surface beside the walkways also seems to help control student movement.

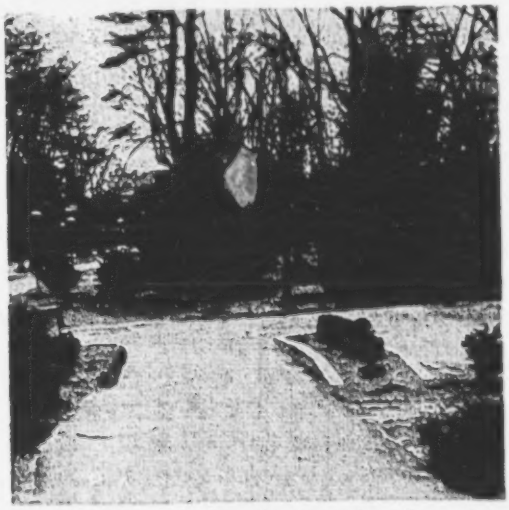
In the past two decades more roads and larger parking areas have encroached on the campus landscape. At many urban campuses parking garages have created new pedestrian movement and desire lines. At rural campuses surface parking lots are used, often at the outer edges of the campus. But security concerns have begun to limit the use of remote parking lots. If the demand for parking is allowed to expand further, the typical college greens will be seriously impacted. Universities should explore alternatives to providing ever-increasing parking spaces.

Planning the campus furniture

Few colleges or universities have site furniture (benches, fences, signs, etc.) that is harmonious with the campus architecture and compatible with the values of the institution. The site furniture is usually the result of accretions over time and of varied solutions to particular needs: a sign for some building, lights for a special area, or a single outdoor telephone station.

Colleges ought to bring order to the profusion of site furniture. But the budget implications of such an initiative are huge. An opportunity often presents itself, however, when a large new project—a new library, science building, or field house—is about to be constructed. In designing the furniture outside the new building, campus planners should use the occasion to design a complete renewal of all the campus furniture. Then, as money becomes available a phased implementation of the overall site furniture system can be carried out.

Colleges should bring order to their site furniture.



Before (left) and after photographs of an area at Babson College after a street was discontinued.

All the elements of site furniture should be considered simultaneously: lights, security devices, bicycle racks, message kiosks, signs, benches and tables, bollards (posts), trash receptacles, fences and rails. Steel supports for benches and trash receptacles ought to be similar to steel members used for fences and bike racks; or wooden benches should resemble wooden light poles and sign supports.

Some institutions prefer to make some of the site furniture in-house, using catalogue items as models and modifying them. Others prefer to buy their benches from one supplier to achieve uniformity. I think colleges should try to build sitting or perching walls. They accommodate more people, avoid visual clutter, and decrease maintenance. Some campuses have chosen to introduce singular furniture such as the wooden benches, stage, and platforms built by students at Duke University's East Campus. These may not be elegant but they are a special student expression which enlivens the campus. The benches sit in front of the residence halls where the landscape has suffered from very intensive use. A more thoughtful, organized landscape treatment, using edges, pavement, and walls to protect the plants, would give this Duke campus area a better look.

Student barbecues are becoming a special landscaping problem. At Duke students pull wheeled barbecues out of the dormitories, requiring special paths for this use. At Williams College students have erected built-in barbecue structures. As barbecue structures become more prevalent, designers should site them carefully and surround them with a well-designed landscape treatment, including structures for student cooks to set down their food and utensils.

To protect pedestrian areas from automobile traffic the use of bollards (thick, wharf-like posts) and gates are often necessary. If access for fire-fighting equipment is imperative, the bollards must be removable. In Europe electronically powered bollards which descend into the pavement automatically are becoming common, but they are as yet seldom used in the United States. An even simpler device, and one less disrupted by ice and snow, is a simple chain attached to two permanent bollards. The lock which keeps the chain in place can be cut by firemen who have tools for emergencies. But it is essential that the chain be completely visible at night. Bollards of wood or metal can be attractive sculptured elements with the college colors or signage.

Many colleges now ask for well-lit campuses.

Trash receptacles are also becoming more prevalent, even on the smallest campuses. The receptacles are essential, of course, near snack bars or barbecue areas; but they are important at many places for this fast-food, throw-away generation. Receptacles are hard to make attractive, but using materials and designs similar to that of other site furniture can help. A particularly difficult item is the rapidly growing use of ash urns just outside buildings as campus buildings become smoke-free. Another new and difficult item is the large dumpsters many campuses use to collect materials to be recycled. However, by designing special areas in the landscape, with good access, well-paved floors, and surrounding planting, colleges can accommodate even the largest dumpsters nicely.

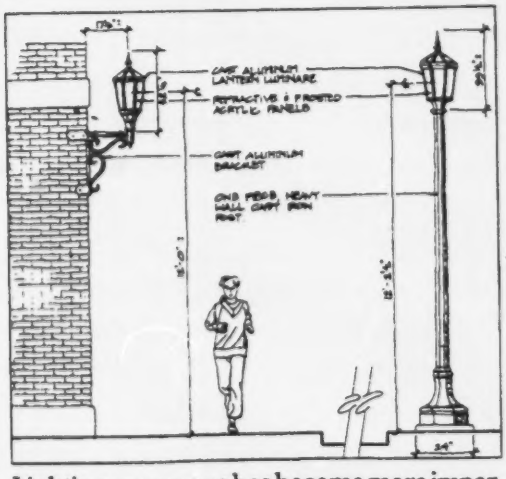
The new security problem

One area where campus landscape decision making has become newly critical is that of security. Where once suburban and rural colleges would request architects to provide restrained outdoor light levels to retain the sense of being in the country, many of the same colleges now ask for well-lit campuses. A skilled landscape architect can design a campus lighting system which gives good visibility without glare and one that has a character different from that of an urban area. But this requires lots of teamwork and a thorough examination of options, and installation of trial areas using different lamps, refractors, and bulbs.

A good lighting system is ineffective, however, if dense undergrowth and shrubbery are allowed to obscure views. The security problem thus compels a regular campus review of overgrown plantings. Plantings need to keep security in mind. Even with open, well-lit areas, many institutions find it necessary to install emergency telephones along remote campus paths. The visual character of these telephones is intrusive; and access to these telephones by police cars is desirable, which usually means costly new pavement.

Two pieces of site furniture are particularly important in determining the character of the landscape: lighting and signage. The two can make a huge difference to any campus' appearance.

Where campuses have a well-established architectural character, a harmonious daytime appearance of light fixtures is almost as important as their night-time function. Fixtures which harmonize with the existing architecture yet are flexible in their way of distributing light are of particular value. I am thinking of fixtures with shields to diminish light on one side and increase it on the other to be used along paths near buildings. Certain fixtures which are ideal for an area of historic buildings may not work so well near contemporary buildings, and in such cases two types of fixtures, similar in some way, may be acceptable.



Lighting on campus has become more important, and lighting fixtures should be similar and appropriate for the architecture.

Next to the quality of vegetation, the quality of signage is the most important aspect of overall campus appearance.[1] A unified graphic system with standard colors is essential. So is the use of similar materials and shapes for all signs. Entrance signs, "you are here" maps, and kiosks for special events notices should be available on every campus.

What should be done about donated sculptures, memorial benches, and plaques to beloved teachers or famous students? A proliferation of these can create visual clutter and maintenance problems. On the other hand, if they are properly placed and

Grass has come under particular scrutiny.

landscaped they can add pockets of interest to a campus. Each college should have a policy about memorials in the landscape. The campus landscape master plan should identify areas where memorial benches, plaques, and sculptured elements would be desirable. For example, Wellesley College has a policy that the Trustees' Grounds Committee must approve all campus memorials, and all plaques must be hand carved in stone. Students can thus study the graphic artistry of various stonecarvers.

Vegetation for intellectuals

Outstanding planning for the soft surface areas—grass lawns, flower beds, shrubbery, trees, grading—contributes hugely to the beauty of a campus. But in recent years, skilled horticultural grounds people have become rarer on campus, and environmental concerns have made sustainable landscape practices a goal at a growing number of campuses. Grass has come under particular scrutiny. Some studies suggest that the resources and equipment to maintain lovely lawns exceed that needed to maintain shrub beds. Yet lawns are a historic, distinctive feature of American college and university campuses.[2]

There are two aspects of this dilemma. One, where landscape architects in the past

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have planted beds of native shrubs on campus to reduce resource depletion, these beds have sometimes been replaced with lawns. The reason? Shrub beds need regular weeding, pruning, and mulching, and at times watering. This must be done by knowledgeable horticulturists, for whom other work must be found in winter. Without such people, shrub beds fill up with weeds and the shrubs lose their shape. Still, if colleges will commit themselves to employing skilled horticultural workers, then more campus areas can be planted with native shrubs, ground covers, and flowering trees instead of grass.

It takes courage and love of natural surroundings to support landscape funding.

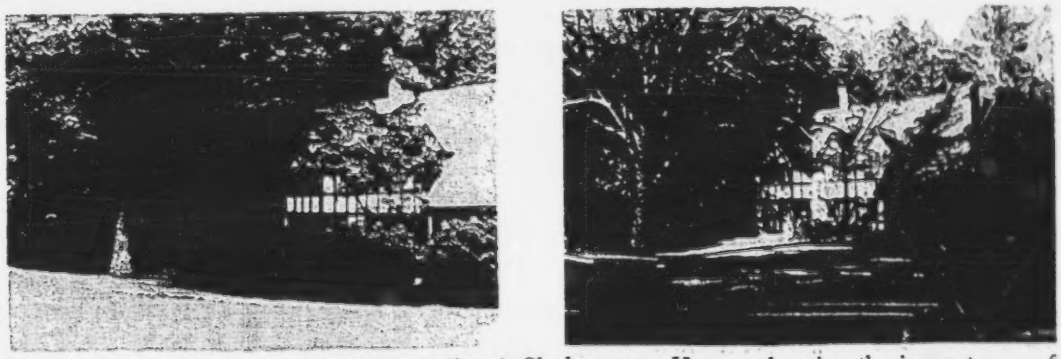
Two, there is little doubt that outdoor rooms of grass enhance the quality of student life. But on rural campuses, college planners can seed some grassy areas with wild flowers and create low-maintenance meadows. Also, campuses can compost grass clippings and leaves so there is symbiosis between the shrubs which need mulch and grass which produces it.

Some universities have an arboretum or endowed botanic garden. Other campuses, such as Davidson College, are arboretums in themselves. The grounds have plant identification tags to make the plantings educational, and the visual quality of this campus makes it a most satisfying environment for living and learning. The character of the tree planting is simple, ordered, and strong. But all campuses with ordered tree layouts have difficulty maintaining their imageable landscape because trees get old or diseased and die. Tree replacement planning is a must. This has been especially vital for campuses with American elms, which are dying off from Dutch elm disease. At Andover Academy pin oaks were planted between each elm. It is important that universities not plant a single tree species everywhere, although rows and allees of similar trees should not be ruled out.

Cases in mind

To illustrate some new directions in campus landscape design and some new approaches, I will comment on a few campuses with which I am quite familiar. Wellesley College has a program for the reuse of bituminous concrete. When existing parking areas are resurfaced, the bituminous concrete is ground up in place, compacted, and then used as a sub-base upon which the new pavement is laid down. If the bituminous concrete surface is removed from the campus, Wellesley people return it to the asphalt plant to be recycled. Babson College and Williams College are employing this same technique for reusing bituminous material.

Both Babson and Wellesley have compost and leaf mold areas which provide organic materials for new plantings, as many



Before and after photos of Wellesley College's Shakespeare House, showing the importance of regular pruning and clearing on campus.

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other colleges also do these days. Wellesley rents a screener once a year and makes its own loam, using a mixture of poor soil stripped from project areas, street sweepings that contain grit spread on snowy roads and pavements in winter, and composted leaves and grass clippings.

New campus lighting is increasingly a collaborative effort. At Williams, the improved lighting was developed by students, administrators, staff, and the landscape architect. My firm met in the evening with students and measured the light levels until the students approved. The final plan provides an average .5 foot–candles with a .25 minimum on traveled ways, in parking areas, and along walkways; and we eliminated floodlights. We found that one particularly interesting version of the typical fixture is a light mountable at the corners of buildings to light two sides with just one fixture.

One last observation. Colleges and universities go through frequent changes. A relocation of the students' mailboxes refocuses student desire lines. A change in the location of the Student Center will require new access for services and new student circulation routes. Landscape design should therefore be continuous, not infrequently episodic. Each change means that the old sites and traffic routes need to be reconfigured. And each change should be made as part of the larger vision or landscape organization that creates a distinctive outdoor space for your college or university.

In the final analysis, campus administrators, trustees, and leading faculty must make a commitment to have a high-quality campus landscape. And it takes courage and a love of handsome natural surroundings to support funding for the landscape when there are so many other campus monetary needs. But only in this way can a campus build and maintain a natural environment that nurtures the scholarly life. ■

ENDNOTES

1. See Robert Brown, "Improving Campus Signs," *Planning for Higher Education*. 21 (2): 1-6.
2. For information on this subject, Richard Dober, "About Campus Lawns," *Planning for Higher Education*. 20 (4): 17-22.

As universities become more complex and open to the public better signage is a must.

Improving Campus Signs

Robert Brown

Campus signage is often one of the weakest design elements we see when we drive into, or walk around, the grounds of a college or university. Though finding one's way around an unfamiliar campus is essential for a visitor, a prospective student and her or his parents, new students, and guest faculty and lecturers, most college planners and administrators do not seem to understand the importance of wayfinding signs and building identifications. Good campus signage is seldom a design priority.

For many academic institutions there still appears to be an attitude that clearly marked signs are not necessary or appropriate on campus, perhaps because signs are regarded as too corporate or commercial. Academics seem to believe that people should write ahead for a campus map or simply ask directions when they arrive. Or, possibly some administrators look back to Oxford, Cambridge, the University of Paris, or the University of Salamanca and see no precedent for campus-wide signage.

For some others, signage is considered to be the responsibility of the architects of the buildings. A few architects do address signage for both the interior and exterior of their buildings; others prefer no signage or small, unobtrusive signs. But an architect is not likely to be asked to contribute to a comprehensive signage program for the entire campus.

But times are changing. Today, most institutions have large adult education programs with nightly or weekend visitors. There are more foreign students and more first-time ethnic college-goers. There are more visiting faculty, speakers, artistic performers, and lectures and concerts for the public. Admissions has become more critical, so prospective students coming to look over the campus require artful guidance through signs. Also, universities have grown more complex, larger, and more in need of directions and identifications. Then too, there is a burgeoning interest in TQM and serving and helping the clients. So better signage now seems imperative.

Regardless of past attitudes, therefore, colleges and universities that wish to remain competitive and to serve the public and their students must now communicate

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more effectively with their constituencies. Excellent campus signs are one of the best ways to convey both image and information to a broad audience.

New world of environmental design

When I graduated from design school and began work as a graphic designer on architectural projects, I found there was little respect for the kind of knowledge graphic designers could bring to built projects. Many architects felt capable of designing all aspects of a project—from landscape components to interiors and furniture, and from outdoor signs to room identifications.

But in recent years the profession of architecture has been dividing into specialties (Gutman 1988), and a new kind of graphic designer has emerged. These are individuals whose interests and expertise are applied to the design of informational, directional, orienting, and regulatory sign systems as well as to other forms of three-dimensional communication. They are called environmental graphic designers, and unlike print graphic designers and sign makers and contractors, they are usually familiar with the comprehensive signage needs of universities, hospital, governmental and nonprofit offices, large exhibits, service companies, and the like, and with

There still appears to be an attitude that signs are not necessary or appropriate.

signage planning and the entire design process. This process includes environmental analysis, preparation of sign message schedules, generation of sign alternatives, sign location, construction details, and signage fabrication materials and techniques.

There is even a relatively new organization, The Society of Environmental Graphic Designers (SEGD), devoted to providing information to designers and clients who wish to know more about environmental design. When embarking on a campus signage program, institutions may find it helpful to write SEGD to get the names of firms specializing in academic sign programs. (SEGD, One Story Street, Cambridge, MA 02138; (617) 868-3381.)

Planning for better signs

The impact of a good sign program can be significant. Besides helping to create a consistent and attractive image of the institution, and saving time and labor by having a standard look for signs, a good sign program can expand pride and improve morale. For example, our firm recently completed the first phase of a signage project that had to be halted because of the

Signage can be introduced in phases over two or three budget years.

college's shortfall of resources. The students, however, were so pleased about the new signs that were installed that they allocated student government funds to allow the signage project to continue. Admissions officers and educators hardly need to be reminded of the evidence that the physical appearance of the campus is often as important in the decision to enroll at a college as the quality of the institution's educational programs.

If a university is considering installing first-rate signs, an early question is nearly always, "How much will it cost?" This is a difficult question to answer simply. A consultant friend of mine responds with another question, "How much does a new house cost?" She points out that just as house construction costs depend on its location, size, quality, and other factors, the cost of a signage program depends on the size of the campus, the complexity of the signage needs, the financial resources available, and other factors.

Still, based on Sasaki's experience with

numerous institutions, I offer some useful estimates in Table 1. For institutions with constricted financial resources, the signage program should be introduced in phases over two or three budget years: analysis, design format, color, and placement decisions in budget year one; fabrication in year two; and installation in year three.

Like much else in higher education, good planning is essential for an outstanding and widely accepted signage program. But frankly, the planning phase is the most challenging aspect of a signage program. Development of a signage program involves not only directional information and signs for individual buildings but also aesthetics and image, and campus persons often have quite varied—and sometimes fierce—views about how the campus should look. In signage many people regard them as amateur experts. Arguments about whether the signs should be quiet and unobtrusive or colorful and bold, old style or modern, wood or metal, Garamond typeface or Helvetica, and using the school's athletic team colors or, say, gray and white, can produce heated meetings about the proposed campus signs.

As a rule, therefore, I encourage each institution to assemble the smallest possible decision-making group to work with the environmental graphic designer. But the group must include the key individuals responsible for communication on campus, persons who can consult subgroups and important constituencies, as well as include the facilties planner of the college.

Wide communications is imperative in the planning and development stage. Once, our firm had gone so far as to produce prototypical mockups for each sign type for review and approval. Suddenly, important individuals on campus appeared who were not satisfied with the design on the mockups. We learned that the signage committee members never informed their constituencies or superiors about the design and review progress. This created a difficult situation for the vice president for administration and the president, and caused bad will toward the signage program. The advance planning must include broad consultation, frequent information sessions, and the presentation of design options.

In signage many people regard themselves as amateur experts.

Elements of good sign design

A good campus signage program has several basic elements. If planners understand what these elements are it makes the design, placement, and implementation easier. Most important of all is a signage master plan that nicely reflects—and even enhances—the nature and essence of a college or university, its values, and its long-range goals. A great sign program is one that is perfectly fitting; the signs signify

TABLE 1

Estimated Costs of a Campus Signage Program

Size of the Institution	Designer's Fee	Fabrication Costs	Total
500 to 3,000 students	$20,000-30,000	$60,000-90,000	$80,000-120,000
3,000 to 10,000 students	$30,000-60,000	$90,000-150,000	$120,000-210,000
over 10,000 students	$60,000-100,000	$150,000-300,000	$210,000-400,000

what the institution is really like. (That's where the disagreements enter, because many on a campus have different views about what the college is really like, or what it should become.)

The sign format. The most basic component of a sign program is its format, meaning its shape, size, and proportions. The format itself can convey a modern or a traditional image. A modern format might look strange at institutions such as the University of Virginia or William & Mary just as a colonial format might look unusual at Washington's Evergreen State College or the University of California at Santa Cruz. Campuses should not mix sign formats, even though they may be tempted to put a different sign format in front of the historic Old Main building from that in front of the new Arts Center. (See Figure 1.)

Fabrication Materials. Careful selection of appropriate materials out of which to make the signs is essential. Traditional sign formats should be constructed of wood or stone, or steel carefully handled, while modern signs are often made of aluminum, fiberglass, or plastic. Some materials connote tradition, others convey contemporary life. Knowledgeable environmental graphic designers are not only well versed in the

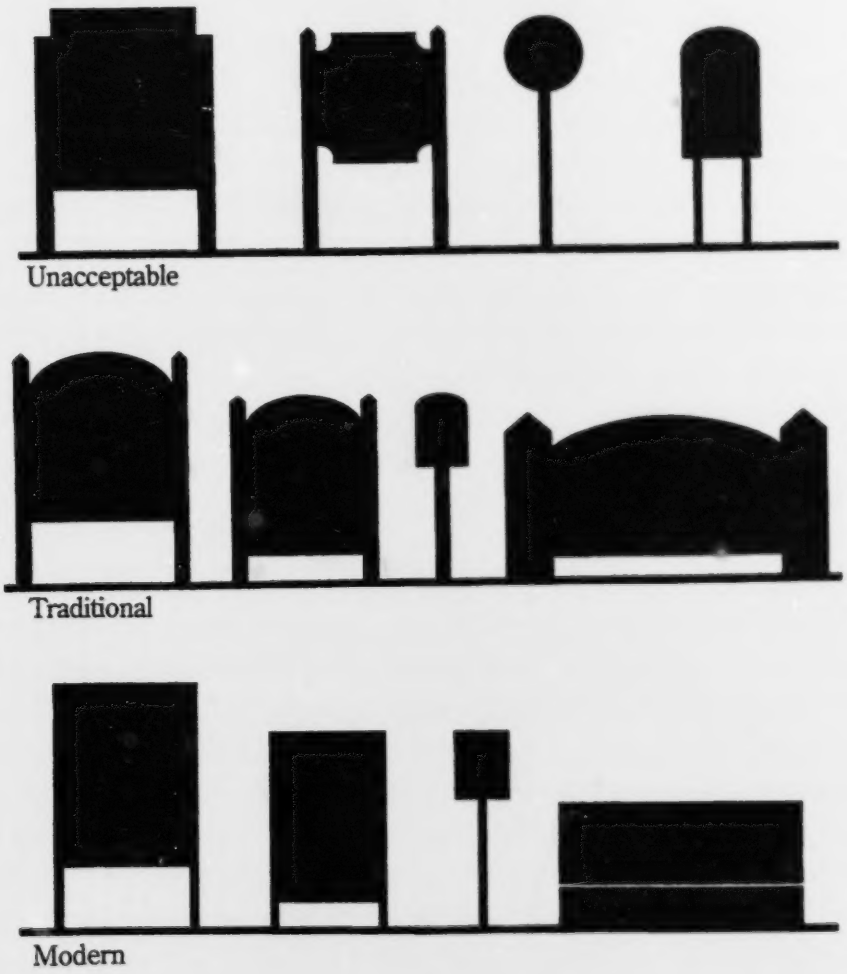

Figure 1. Sign formats.

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aesthetics of materials but also familiar with fabrication techniques that will produce signs that are economical and durable.

Typestyle. Many colleges and universities use a specific typeface for their stationary, publications, and vehicles. (Think of the gothic type of the *New York Times* and

Signs signify what the institution is really like.

the *Chicago Tribune* mastheads or the modern sans serif type of airlines such as Swiss Air and United Air Lines.) In some cases the familiar typeface of the stationary may not be suitable for signs because of poor legibility, as in the case of a script typeface. Signs need to bequickly and easily readable.

An environmental graphic designer can help a college select a proper typeface for the signs. Typefaces have character. Some, like Caslon, suggest colonial times; others, like Franklin Gothic, look modern; and others appear 19th-century American, chic-urban, rustic, etc. Once a typeface has been selected and approved, it should be used throughout the entire signage program to create a consistent image.

The Graphic Layout. The next decision to make is how the graphic elements—the name of the institution, the name of the building or the directional information, the rules or borders, and the possible inclusion of the institution's seal or logotype—will be arranged on the signs. (See Figure 2.) How these elements are arranged on the sign helps determine the look of the sign system, and can enhance or frustrate the overall aesthetic. For example, traditional signs frequently have borders, contemporary signs seldom do. Again, whatever relationship of the graphic elements is decided upon, that layout should be employed for each sign.

Colors of the Sign. Colleges and universities generally have their school colors. In most cases these colors are the logical ones to use for the signs. However in some situations where the school's colors do not offer sufficient contrast—pink and white,

Typefaces have character.

yellow and white, or dark green and black—a substitution of one of the colors may be necessary. Also, when there is a hierarchy of information to be conveyed at some locations, it may be useful to add a third color.

Location of the Signs. Part of any good signage master plan is an analysis of where signs are needed and exactly where they

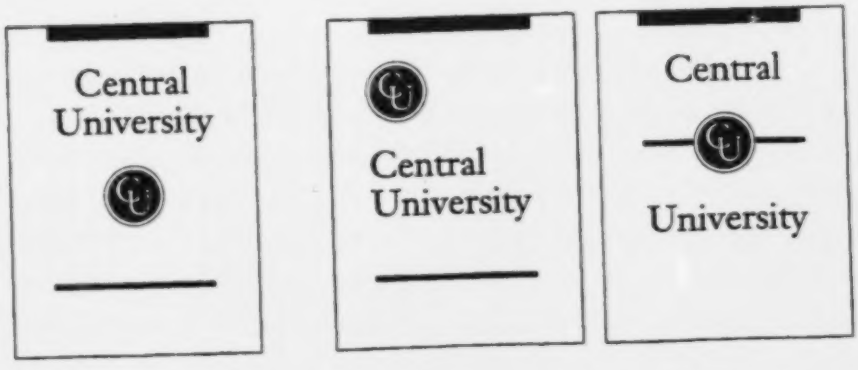

Figure 2. Alternative graphic layouts for signs. The arrangement of graphic elements seems more harmonious in the sign at the left.

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should be located. Here the environmental graphic designer, usually a stranger to the campus, can be a special help in locating informational and directional signs, while the facilities planners and campus communications experts, who are more knowledgeable about the campus, can help locate the identity and regulatory signs. Positioning signs in a consistent manner in relation to building entrances, paths and walkways, street furniture, etc. is important for a successful signage program. For example, the optimum position for a building identification sign is to the right of the door, and this should be done for all buildings. (Figure 3.)

Good signs are a mark of courtesy.

The new law

In 1992, Congress passed the Americans with Disabilities Act. While the majority of the Act deals with architectural requirements, there is a section that discusses new signage requirements. Most of these requirements do not regulate exterior signage, but the impact on signs inside buildings is considerable.

Most colleges and universities will need to redo their interior signs in the next few years, especially those which identify permanent room spaces. These room signs must contain both raised, tactile capital letter forms and Grade Two braille. Letters must be at least 5/8-inch high, and there must be a strong contrast between sign words and the background field of color. The Society of Environmental Graphic Designers has published an interpretive document on the ADA and its new signage requirements.

The neglect of good signage, even by authors who say they want to make the campus "a work of art" (Gaines 1991), should come to an end. Artful signs for newcomers to the campus can be nearly as important as the campus open spaces, landscaping, building exteriors, and interior design. If nothing else, good signs are a mark of courtesy by the college's leaders and faculty to all who wander through their campus. ■

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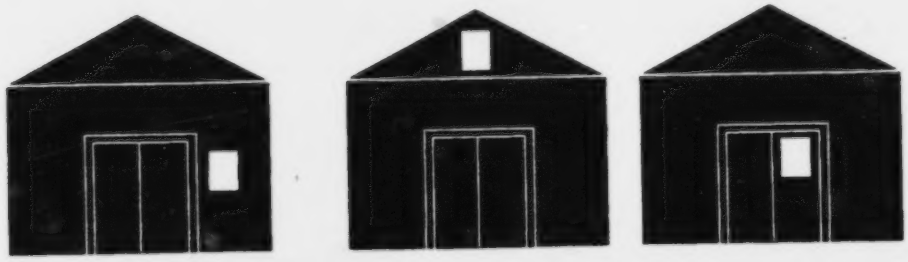


Figure 3. Location of building identification signs. Signs should uniformly be located to the right of building doors, not scattered in several locations, as on the two buildings at the right.

How colleges can design buildings to foster collegiality and productivity.

Campus Architecture That Shapes Behavior

James Burlage and Wendell Brase

As available land at colleges and universities becomes scarcer, institutions have been forced to build taller buildings—four to eight stories instead of two or three. This has led to the separation of people on campus by floors because visits, conversations, and socializing tend to take place more easily in horizontal spaces. Floors are more confining than walls. Persons will often walk 160 feet down the hall to visit someone, but balk at going up or down one flight of stairs to confer with someone closer.

This architectural situation exacerbates the already fragmenting academic life that exists at all but the smallest colleges; and it contributes to the increasing loss of community, friendship, and scholarly collaborations on campus. So the question arises: how can architects design for improved social interactions and better academic productivity in the new mid-rise college buildings?

First, an assumption. We believe that built environments should serve people's needs, especially their social needs. To us this is the essence of good architecture. Buildings should be more than masonry sculptures or imaginative flights of architectural artistry. We can shape social behavior to a certain degree by the spaces we create.

Social and intellectual exchanges are critical for colleges and universities. This seems to be particularly so for the laboratory-based sciences and engineering, where teamwork rather than the efforts of isolated individuals is vital to research productivity. But the need for interaction is not limited to the sciences and engineering. Academic and facilities planners should demand that building renovations or new architecture pay attention to the enhancement of exchanges and visits among all faculty, students, and staff. How can this be accomplished?

James Burlage, FAIA, is a principal of Burlage & Associates Architects of Sausalito, California, and an award winning architect who has designed 17 college and university libraries as well as campus office buildings and scientific research laboratories, and has conducted master planning at institutions such as Stanford. He is a graduate of the University of Notre Dame who received his M.Arch. from Columbia.

Wendell C. Brase is Vice Chancellor – Administrative and Business Services at the University of California, Irvine. With nineteen years of experience in the UC system (thirteen years at UC Santa Cruz, six years at UCI), Mr. Brase is responsible for UC Irvine's administrative, financial, and business services including a comprehensive program of process improvement and administrative streamlining (recently awarded first-place in NACUBO's Higher Education Awards Program).

Distance as an enemy

The most important factor in determining the amount of interaction in a workplace is the distance that two people have to travel to converse. Several studies indicate that strong interaction is most likely within a 30-foot radius. One professor of engineering management, Thomas Allen of MIT, has shown that the probability of exchanges drops close to an asymptotic level when the distance within a building between two individuals exceeds 50 meters or so, or 165 feet (Allen 1977, 1980).

Planners should demand that architecture pay attention to the enhancement of exchanges and visits.

So the first thing to keep in mind is the desirability of keeping university people close together as much as possible. With mid-rise buildings this may actually be easier to do than with low, sprawling structures.

For example, in the design of the Sinsheimer Laboratories at the University of California, Santa Cruz, the building's designers, ED-2 International of San Francisco, made use of this finding. Peter W. T. Wong, ED-2's principal-in-charge, and key science faculty visited Dr. Allen at MIT and toured Boston area projects to study features that promote collaborative work and research productivity. As a result, the architects clustered all the faculty and staff offices at Santa Cruz in a central mid-rise building, segregated from the laboratories, which are contained in two flanking wings. In the 50-meter envelope (including the vertical transition distance), they carefully placed numerous "magnets" to pull people together: drinking fountains, restrooms, mailboxes, bulletin boards, photocopiers, vending machines, and conference rooms. The "magnets" are important to draw faculty out of their offices or laboratories to the interactive node of the building. And separating the offices from the labs requires walking, and encourages chance meetings and communication.

Thomas Allen has said, "The Sinsheimer Laboratories building goes further than any other university project I know in making use of the behavioral research that links internal architecture to academic productivity." Wong and ED-2 International have recently extended the interaction-producing design concepts to laboratories at the University of Minnesota and IBM.

Faculty who work in Sinsheimer Labs seem to like the building too. Charles Daniel, a biology professor, reports, "One of my recent grant proposals would never have come about without the discussions I had with John Tamkun and Cliff Poodry [faculty in other specialties]." Others use words like "obvious" to attest to the design's benefits from tighter interaction patterns. And Howard Wang, chair of the biology department, says, "The more frequent interactions translate into new ideas for research and different approaches for experiments. You can actually feel the way the building acts as an intellectual catalyst."

The four promoters of talk

We think there are four spatial arrangements that are most conducive to greater faculty, faculty-staff, and faculty-student meeting and exchanges:

1. public spaces
2. functional rooms
3. support spaces
4. circulation

Public spaces. Nearly everyone knows about the town squares of European cities or the village greens of East Coast towns in America. These are the places where the public gathers. They unite a city, town, or village (Whyte 1980), allowing people to eat, talk, trade, stroll, or rest together. Some campuses also have quadrangles, inner courtyards, or central lawns bordered by patios where people gather.

Universities can provide such public spaces for their mid-rise buildings, through the design of one of three kinds of public space. One means is through the location of a new building adjacent to a campus space

that allows for the creation of an outdoor area where faculty, students, and staff can gather, whether in a small park-like setting or a small, landscaped plaza with special paving. This is obviously more appropriate for colleges in warmer climates.

Stairway at the Sinsheimer Laboratories at the University of California, Santa Cruz. In mid-rise campus buildings vertical circulation becomes especially vital.

The other two kinds of public spaces are a courtyard and an atrium. The building can be a hollow square or U-shaped structure with an inner courtyard containing a fountain, sculpture, trees, shrubbery, benches, or flowers. The courtyard is a more private realm than the "town" square beside a college building, but it draws people together effectively too, as medieval cloisters and Spanish inner spaces do.

An atrium was an open courtyard in large Roman houses; but today the term is usually used to describe a covered courtyard or glazed winter garden inside a building. Modern atrium design incorporates special wall enclosures, sunshading, ventilation devices, and subtle means of controlling temperature and humidity. The Ford Foundation's headquarters in New York City has a striking atrium, and Graham Gund placed one at the heart of Davidson College's Visual Arts Center. (Gund and Dorsten 1994, p. 23). Atriums have become popular recently for linking floor levels within a large interior space because they increase visual awareness between floors—people can see both horizontally and vertically to the other floors—and help break the sense of enclosure. The building's users share views, light, noise, and smells and can gather easily in the central space.

Functional rooms. These are rooms that allow faculty or other campus persons to carry out some task. Daily routines are filled with such tasks. These include formal rooms such as lecture halls, laboratories, conference rooms, and libraries, and informal rooms such as cafeterias, lounges, exercise rooms or gymnasiums, locker rooms, and administrative offices. The location of these functional rooms can enhance meetings, as can the rooms' shape, enclosures, scale, furniture, light, and views.

Magnets are important to draw faculty out of their offices.

For instance, the Sinsheimer Laboratories have two-story conference rooms designed to function with either closed or open doors, inviting unscheduled, spontaneous use. Faculty have found these conference rooms most useful when their use is least structured, and meet there frequently for impromptu discussions. One problem is that students also find the conference rooms attractive places in which to study or discuss academic assignments.

Atriums have become popular for linking floor levels.

Support spaces. A majority of traffic in a building results from the movement to and from certain necessities during the day: restrooms, supply rooms, vending areas, information display spaces, drinking fountains, coffee stations. What is common to these support spaces is their opportunity to attract people. So their location and the design of these spaces must be such that they induce conversations.

At Stanford University's Terman Building the snack bar and lounge spaces were located in a highly trafficked area and created a wonderful activity space. To get to the restrooms in the basement, persons had to penetrate this activity zone, further enhancing the use of these support spaces. Also at Stanford, in the Keck Building, the drinking fountains, copy machines, coffee machines, bulletin boards, and writing boards were all situated along the atrium corridor, pulling people into meetings and conversations informally all day long. A unique device for drawing people together was the seismograph machine in Stanford's Mitchell Building. During periods of ground tremors in California or elsewhere people on campus rushed to the machine. (It is probably the only crowd attraction in the Mitchell Building.)

Moving people on campus

Circulation. The circulation spaces may have the greatest effect on how people per-

ceive a campus building. Also, one's orientation to a building is highly dependent on her or his understanding of the circulation configuration. The paths connecting the various functions can promote or deter interaction. Circulation networks include both horizontal and vertical movement. Especially important, the intersections and terminations of circulation paths are among the most active social spaces in a building.

Horizontal spaces are made more welcoming to interaction if the corridors can be single loaded, with office doors on only one side of the corridor. Atriums or courtyards facilitate this kind of corridor. Double loaded corridors, with doors on both sides like hotel corridors, have a strong institutional feel and retard social exchanges. But corridors have four faces, and the walls, floors, and ceiling can be manipulated to establish greater variety and interest. Walls, for instance, can be punctuated with lounges and other open spaces. As for the larger horizontal spaces such as the entrance lobby or a courtyard, these can be partitioned by columns or low walls to define movement and by furniture and indoor landscaping to create tidy interaction spaces.

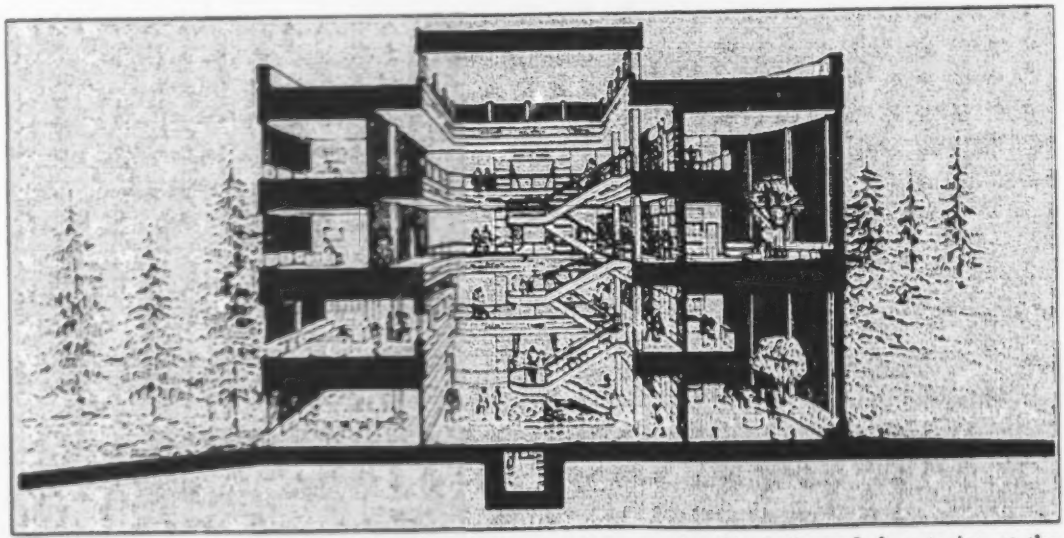
Vertical circulation connecting the floors of a building has become more important as university buildings have increased in height. But stairs can be designed to be inviting and attractive, with large landings where passersby can stop and converse. An especially nice touch is if the landings have a view into active areas, perhaps through location open to an atrium space, to encourage persons to pause and observe the building's users.

Elevators are of course necessary for multi-story buildings and for the disabled. But elevator speed can encourage movement up and down. And the lobbies in front of each elevator entrance can contain bulletin boards, a few chairs for impromptu discussions, and acoustics that permit informal comments and introductions. As campus buildings shift from low-rise to mid-rise, the importance of fresh, imaginative design of vertical circulation cannot be overemphasized.

Campus architecture should be grounded in the research on behavior.

Robert Geddes, dean of Princeton's architectural school in the 1960s, once wrote:

> There are limits of size for every group beyond which friendships do not form...The frequency of involuntary, personal face-to-face



Cross-section of the office core building, with its atrium, at the Sinsheimer Laboratories at the University of California, Santa Cruz. The aim is to provide maximum exchanges among the faculty and between faculty and students.

contacts is one of the most important factors in the formation of groups and informal friendships. The layout has a direct bearing on the formation and maintenance of informal social groups. Circulation, as well as various programmatic and support spaces, must be designed to facilitate interaction.

With the advent of more and more mid-rise buildings at colleges and universities, the necessity of designing spaces that encourage and increase chance meetings, informal discussions, intellectual exchanges, and views of other persons at work has increased. Campus architecture should be grounded in the research on behavior, especially intellectual work behavior; and must make good social interaction and high productivity a goal for its design. ■

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BOOK REVIEW

Landscapes, Work, and People

A Sense of Place, A Sense of Time, by John Brinckerhoff Jackson. Yale University Press, 1994. 205 pages. ISBN 0-300-06002-5.

Reviewed by George Anselevicius

While John Brinckerhoff Jackson taught the history of the American landscape at both Harvard and Berkeley, he used to drive his motorcycle between the two universities so he could experience the countryside and explore its byways. This devotion to understanding the American environment also prompted him to publish and edit *Landscape* beginning in 1951, a journal that became one of the most influential publications in its field.

Now the 85-year-old cultural geographer and pioneer of landscape studies has collected 14 of the essays he has written during the past decade in *A Sense of Place, A Sense of Time*, a book which continues his lifelong observations of and insights into the physical realities that surround us all. Jackson's fascination is with how the land we live on has been shaped by and for human needs, especially "the more popular, more everyday symbols in the American landscape." The book includes views on tool sheds, small churches, trucks, gardens, mobile homes, and roads; and it contains black-and-white illustrations that range from a garage in New Haven to a Zuñi Pueblo dance.

Jackson's prose is elegantly lucid without pedantry and hyperbole. He spares us the esoteric complexity and pretentiousness that seem fashionable in much architectural and literary writing and criticism at this time. The footnotes are scarce, but the observations are many, first-hand, and often striking. Jackson prefers to study life and people directly as well as other scholars' articles and books.

Jackson is a 20th-century original—unconventional with a no-nonsense concern for the rich tapestry of humanity and nature. He is no model for romantic preservationists. He sees history from the bottom up rather than from the top down. It is not the landscape of fashionable thinking or of bourgeois and aristocratic styles which tend to emphasize leisure, pleasure, and pictorial beauty, but is a landscape that is regional and shaped without much pretense for the practical and commercial uses of the vast majority of working people. Jack-

George Anselevicius, FAIA, is professor emeritus at the University of New Mexico's School of Architecture and Planning, where he served as dean from 1981 to 1993. Previously he was chairman of Architecture at Harvard's School of Design and at SUNY Buffalo and served as dean of the architecture school at Washington University in St. Louis. A graduate of Leeds School of Architecture in England, he has received several design awards for his architecture and has published numerous articles.

son writes of places and times where ordinary people struggle weekly with the difficulties of living and making a living in their small communities. To him, this gives our landscape its true meaning if not beauty. Yet he has only dismissal for Marxist working class dogmas.

Nor is Jackson a model for the radical environmentalists, most of whom, he notes, come from the upper-middle class. He confesses:

> I have no great liking for wilderness and forest, but like the majority of Americans I am fond of trees: individual trees, trees in rows along the street or in orchards, trees in parks.
>
> I myself have no liking for the cultural anarchy preached by the radical environmentalists. All too often their credo resembles that of some obscure and short-lived Christian heresy in which the cross would be interpreted as the symbol of the dismembered forest tree...

He views the Sierra Club and other rabid environmentalists as producing "a body of anti-urban, anti-technological, anti-people, anti-history books and pamphlets, all anthrophobic, all urging us to worship nature." Jackson sees people as an integral part of the landscape, like birds; and he honors the human work ethic and persons who labor hard to feed, clothe, and house themselves and to find a little merriment, peace, and joy in a hostile world.

As for architecture, Jackson thinks it is being displaced by roads, highways, and airports—a new network of arteries to provide accessibility.

> Architecture no longer provides the important symbols. Architecture in its oldest and most formal sense has ceased, at least in our newest landscapes, to symbolize hierarchy and permanence and sacredness and collective identity...A landscape tradition a thousand years old is yielding to a fluid organization of space that we as yet do not entirely understand.

Roads, for him, are creations like buildings, symbolizing freedom and providing new connections between people. He sees cars, trucks, and airplanes as a new human resource. But he says the landscape of roads, automobiles, and the ubiquitous and democratic grids exposes a paradox: on the one hand a marvelous new mobility and flux, and on the other hand people's perennial need for stability, sense of belonging, and sense of place.

Gardens, trucks, and all that

A Sense of Place, A Sense of Time is organized into three parts. In part one, the author, who lives outside Santa Fe, New Mexico, offers five essays about the harsh, dry landscape of the Southwest. He writes of the cultural traditions, dwellings, and communities of the Native Americans and the Spanish settlers, and about the new face of the region which includes many mobile homes, now a prominent part of the landscape.

Part two is entitled "Environments." Here Jackson discusses how much of America and Europe has changed from a wilderness to a land to support utilitarian needs. It includes a superb essay on enclosed "vernacular gardens," which are almost "unknown in subtropical regions of Africa and Asia." He traces the development of gardens from a vital source of food, herbs, and flowers "essential to the welfare and cohesion of the family" to the contemporary "sterile display of close-cropped grass and foundation greenery." The section also contains an essay on "Working at Home," leading readers to assume it will be a discussion of computers and other devices. Far from it! J.B. Jackson is more concerned with working-class families where the home is less a private refuge and more a resource for generating income through auto repairs, upholstering, haircutting, or baking.

Jackson's fascination is with how the land has been shaped by and for human needs.

In the third part, "Towns, Cars, and Roads," Jackson's four essays address issues which I believe are as close to his heart as any: roads, cars and trucks, America's use

of grids as a way to organize space, and the difficulty Americans have finding a sense of place. He says,

> The truth is, Americans are of two minds as to how we ought to live. Publicly we say harsh things about urban sprawl and suburbia, and we encourage activity in the heart of town. In theory...we want to duplicate the traditional compact European community...But at the same time most of us are secretly pining for a secluded hideaway, a piece of land, a small house in the country.

As a result he believes most of us get our "sense of place" largely from events, not buildings—a graduation ceremony, a religious revival service, a football game with a traditional rival, a country fair, dinners on Sunday, Thanksgiving, and Christmas.

> The average American still associates a sense of place not so much with architecture or a monument or a designed space as with some event, some daily or weekly or seasonal occurrence...What made the marketplace significant was not its architecture; it was the event which took place there...It is our sense of time, our sense of ritual, which in the long run creates our sense of place, and of community.

Colleges in the landscape

What does Jackson's outlook mean for colleges and universities? Colleges are both a place of work—like a factory, monastery, or large office building—and a place of retreat, a landscaped park, an enclosed sanctuary. Campuses always need to plan both for industry and productivity and for contemplation and memorable spaces that stimulate events and life-shaping exchanges. If we agree with J.B. Jackson, colleges also need to design their academic years to have the kind of social events that stick in our memories over a lifetime.

Architecture no longer provides the important symbols.

A Sense of Place, A Sense of Time links the god-given grandeur of the earth's landscape with the fragile, man-made landscape of working people who must fish, make tools, write books, and cook food in order to survive. Without preaching, J.B. Jackson reminds us of necessary and simple realities. The book is a refreshing counterpoint to much of the expressionistic elitism in contemporary architecture and divisive ideologies in modern society and academic life. Jackson, who is a guru to some, gives no prescriptions but he continues to point to the basics of life and work and to the issues which could lead to a more civilized landscape. ■

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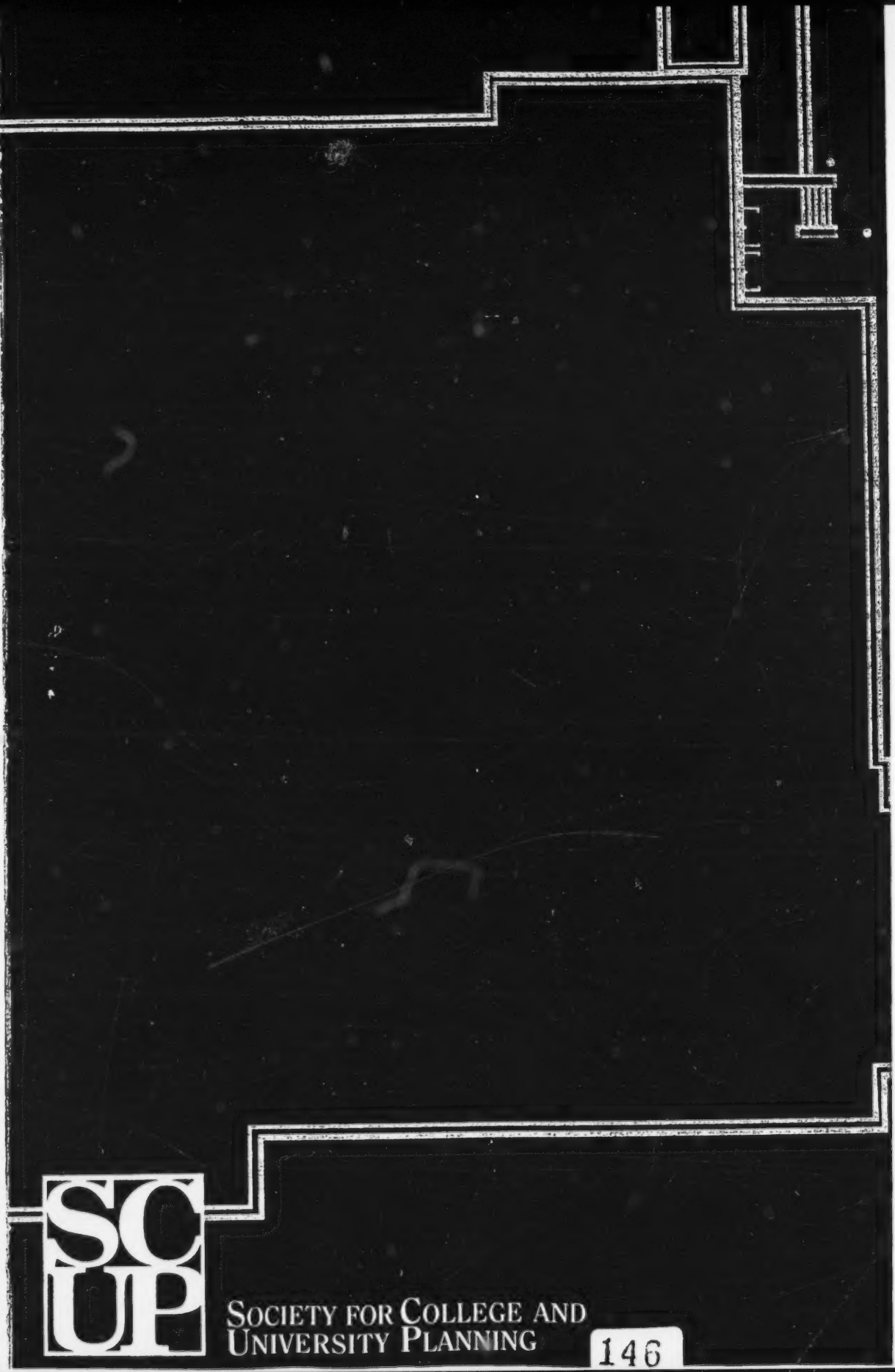

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